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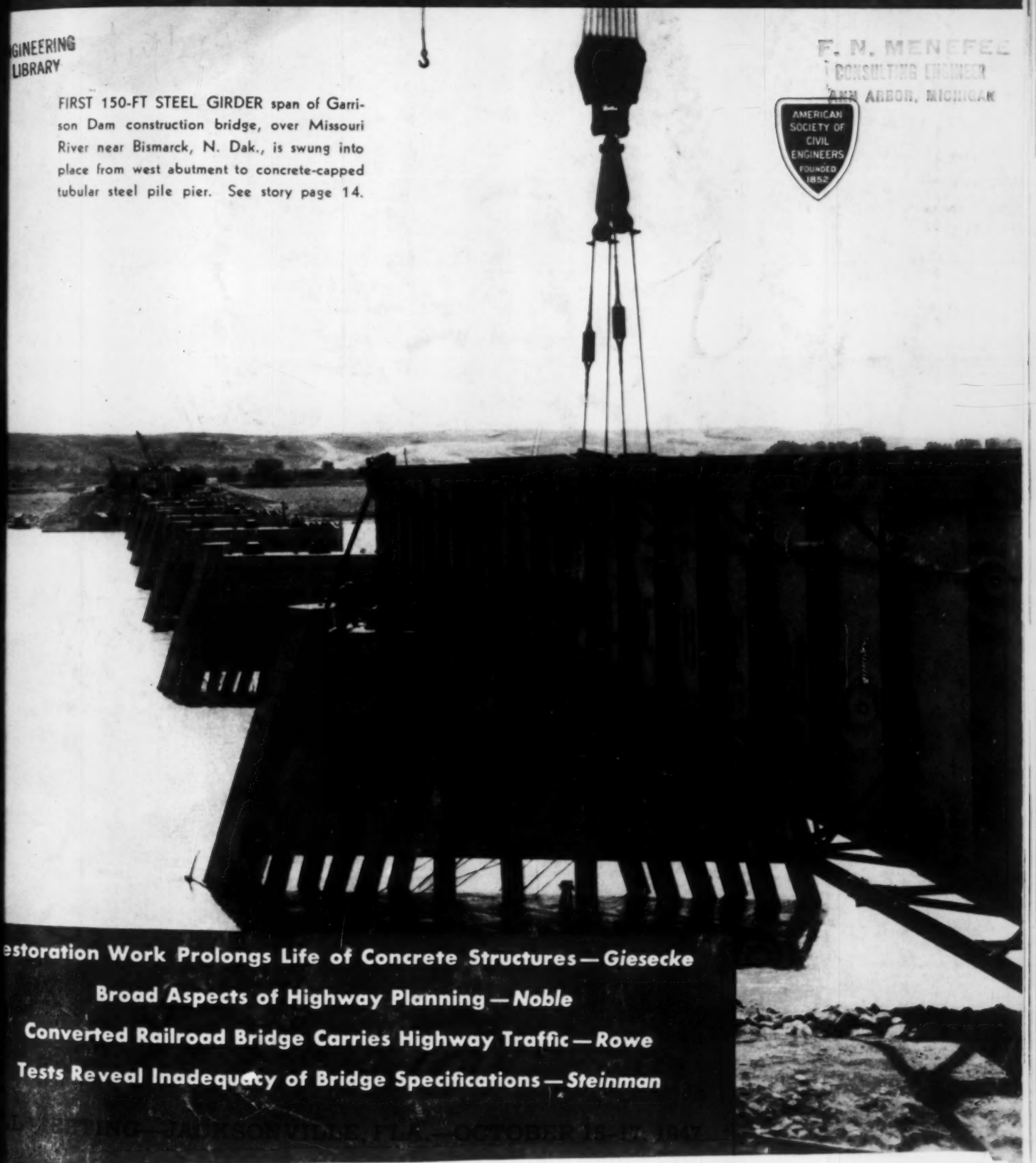
FIRST 150-FT STEEL GIRDER span of Garrison Dam construction bridge, over Missouri River near Bismarck, N. Dak., is swung into place from west abutment to concrete-capped tubular steel pile pier. See story page 14.



estoration Work Prolongs Life of Concrete Structures—*Giesecke*

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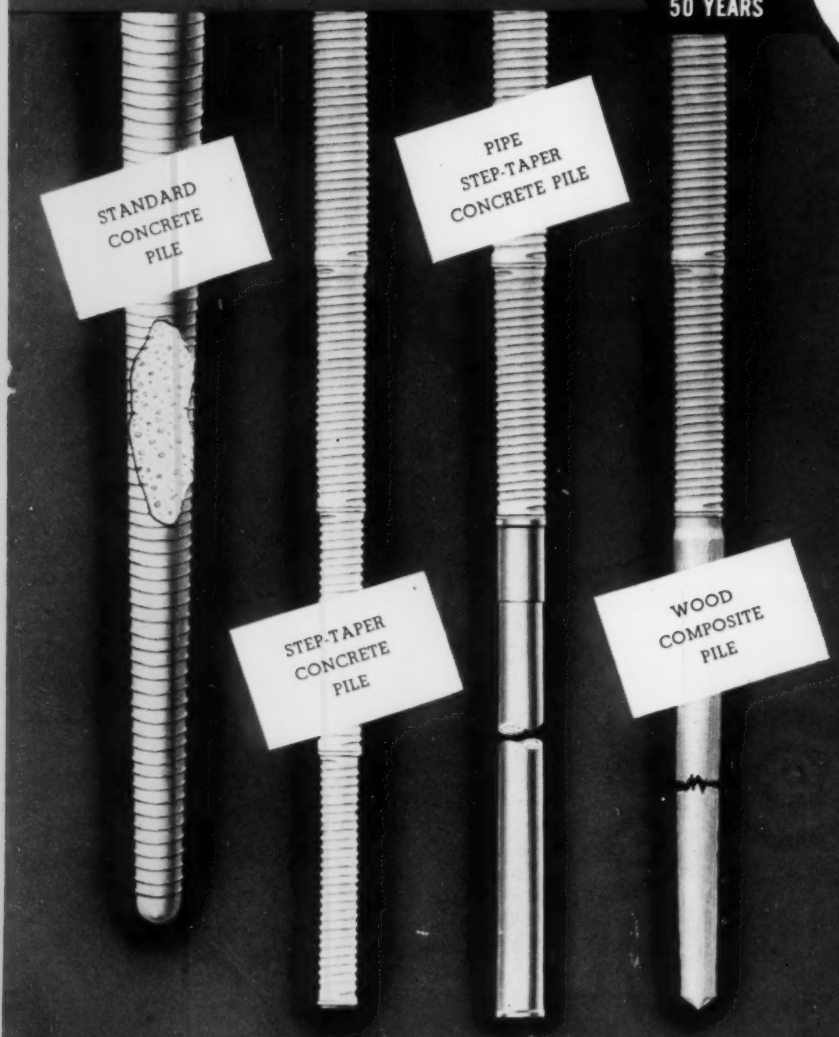


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OCTOBER 1947
Volume 17 Number 10

# CIVIL ENGINEERING

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# Six Divisions to Hold Technical Sessions in Jacksonville

*Florida Section Host to Fall Meeting, October 15–17*

AT THE FALL MEETING of ASCE in Jacksonville, October 15–17, programs of outstanding technical interest are to be presented by six of the Society's 13 Technical Divisions. Those in session will be City Planning, Construction, Highway, Sanitary Engineering, Structural and Waterways.

Subjects chosen for discussion by the Divisions are designed to be of both local and national interest. For instance, the Waterways Division will present a program featuring a symposium on tidal rivers, using as examples the Savannah and St. John's Rivers. Speakers on this subject include Ralph F. Rhodes, Harold A. Scott and Henry B. Simmons, all closely associated with the solution of river phenomena in their work with the U.S. Engineers. Chairman W. W. DeBerard will preside at this session on October 15.

### Federal-Aid Urban Highways

The City Planning and Highway Divisions are joining forces in Jacksonville to trade ideas on the planning, location and function of federal-aid urban highways. Charles M. Upham of the Highway Division will be in the chair for the combined meeting. The subject of "travel habit" surveys will be discussed by E. H. Holmes of the PRA, while W. M. Parker, of the Florida State Road Department, will tell about the interstate highway through Jacksonville. Chairman Frank H. Malley of the City Planning Division will lead the discussion of this problem.

Two sessions are scheduled by the Structural Division in an attempt to give at least part of the attention deserved by the subject—the grading, design and treatment of structural timber. A large number of experts—including Howard Hansen, Ralph Mann, J. H. Carr, A. G. H. Dietz, E. G. Stern, R. P. A. Johnson, Frank J. Hanrahan, and W. H. O'Brien—will discuss various aspects of the subject. Jewell M. Garrelts, secretary of the Division, will preside at the sessions.

### Construction Men Cite Bidding Practice

At the session of the Construction Division on October 16, Elmer K. Timby will introduce speakers with three subjects of widespread interest in the construction industry. Clearer, more precise specifications and contracts will be the subject of the paper by George B. Hills and Charles F. Lovan.

Operation of the Building Research Advisory Board will be discussed by R. H. Tatlow III, of New York. The third speaker on the program, E. M. Rader, will detail the construction of the Rickenbacker Causeway.

### Stream Improvement and Water Treatment

Another Division to hold two sessions in Jacksonville is that on Sanitary Engineering. Subjects to be studied include water treatment in the South, lime recovery at the Miami plant, sea water regeneration of Zeolite plants, South and Central American sanitary engineering, Florida's research facilities for sanitary engineering and the program for stream pollution abatement in the South. Speakers will be W. A. Moggio, David B. Lee, C. D. Williams, Clarence Sterling, Wylie W. Gillespie, Charles Richheimer, Claud F. Wertz, Malcolm Pirnie and Richard Hazen. John H. O'Neill, secretary of the Division, will preside.

### Entertainment Featured

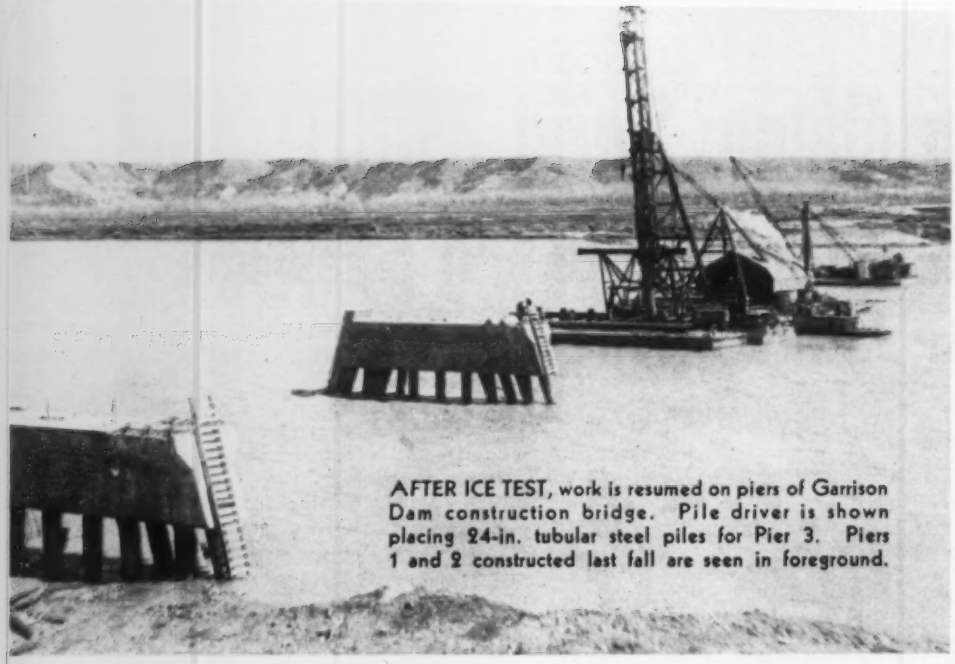
Justly proud of the opportunities for trips of interest and entertainment in and about their city, the Local Meeting Committee, headed by Mr. and Mrs. Robert M. Angas, have scheduled trips, dinners, luncheons, parties and—well just about everything to help the convention-goers enjoy their visit to Jacksonville.

Several other features will draw special groups. The Board of Direction and several of its committees will meet and conferences will be held by delegates of Local Sections and Student Chapters in the southeastern section of the United States. All in all there is plenty of pleasurable anticipation for a profitable and pleasant meeting in Jacksonville.

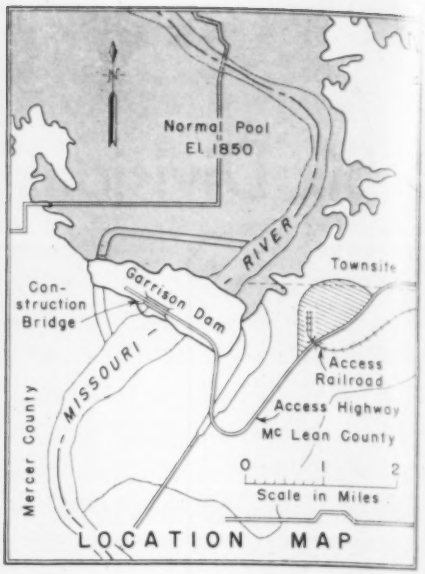
### Hotel Reservations

Owing to the crowded hotel situation, members are urged to make hotel reservations early. See September issue of CIVIL ENGINEERING for a list of hotels and rates.

DEEP-WATER HARBOR and many terminal facilities make Jacksonville a hub for Southern industry. Famous for years as resort center, city now boasts 426 industries producing 450 different commodities.



AFTER ICE TEST, work is resumed on piers of Garrison Dam construction bridge. Pile driver is shown placing 24-in. tubular steel piles for Pier 3. Piers 1 and 2 constructed last fall are seen in foreground.




# Tubular Steel Pile Piers Withstand Rigid Test

## *Two Piers of Garrison Dam Construction Bridge Are Subjected to Unusual Ice Load*

ERNEST E. HOWARD, M. ASCE

Howard, Needles, Tammen & Bergendoff,
Kansas City, Mo.

TUBULAR STEEL PILES driven to depths below low water varying from 93 to 166 ft to support the construction bridge at Garrison Dam near Bismarck, N.Dak., withstood the tremendous forces imposed by an ice jam during the early spring breakup of the frozen Missouri River. Piers shown on the front cover of May 1947 issue of CIVIL ENGINEERING—and described in an article on the $158,000,000 Garrison Dam project in that issue—were designed and developed by Howard, Needles, Tammen & Bergendoff, Kansas City, Mo., who planned the substructure and superstructure for the combination railway and highway bridge. A discussion of the development of an unconventional pier design to meet the particularly difficult conditions involved in the construction of this bridge is presented herein.

NEW TYPE PIERS built of tubular steel piles of $^3/_4$-in. welded plate 24 in. in diameter, driven into the bed of the Missouri River to support the projected temporary construction bridge at Garrison Dam, withstood a test early this spring that few permanent structures have experienced. Although the bridge is slated for a life of only about six years, and is planned for maximum salvage, its sound design enabled two piers nearly completed last fall to come unscathed through the winter under probably the greatest ice jam experienced on that part of the river.

Two of the eight piers in the structure were built and completed, except for cable bracing, in the fall of 1946. Work closed down about November 30, 1946, and was not resumed until April 1, 1947. In the latter part of March 1947, the two completed piers were subjected to forces exerted by masses of 3-ft-thick ice that piled up first against and then on top of them—to a height of 15 to 17 ft. When the ice jam moved out the piers were checked and found to be undisturbed in line or elevation—and apparently undamaged.

### Development of Unusual Pier Design

Although an ice jam of the magnitude experienced this spring was not predicted, the unusual design features of the tubular steel pile piers permitted them to resist the extraordinary forces exerted—and permitted, with no delay in construction, raising the grade of the bridge 10 ft to minimize the possibility of damage in the event of another severe ice jam.

The concept of the pier design grew from study of many special

ICE JAM EMPHASIZES need for higher roadway grade than called for in original design. View at left shows moving ice splitting on steel-encased nose of pier. View at right shows pier (arrow) under severe test of ice that piled as high as 15 to 17 ft over structure.

conditions involved in the bridge problem which, it was evident, no conventional type of pier would be able to meet. The piers were designed to support a bridge providing two lanes for heavy highway traffic, a sidewalk and a lane for railroad traffic. Its highway load—to consist of heavy earthmoving equipment and construction materials for the 90,000,000-cu yd earthfill dam—is about twice the standard H20 S16 loading usually specified. Its railway design load is E50.

Although the nine-span, 1,350-ft structure will serve but five or six years and then be removed, it is designed with strength and stability equal to that of many permanent bridges carrying heavy live loads. Ease of removal, use of elements readily adaptable for re-use and maximum salvage value—obviously desirable characteristics—influenced the design. These factors were considered in selecting girder spans instead of truss spans for the superstructure.

### Influence of Remoteness of Site

Remoteness of the proposed bridge site had its influence on the design of the structure. All materials including contractor's plant and equipment were to be hauled in by road. Absence of improved roads for several miles of the haul distance suggested a design requiring minimum bulk of materials, that could be built with the fewest different elements of construction plant. Need for early completion called for a type of pier that could be constructed expeditiously in the short working season.

Well-known violent vagaries of the Missouri River, to which the bridge

**CREST OF RIVER LEVEL** at El. 1704.0—more than 6 ft over elevation of pier cap in original design—is indicated on photograph. Shown standing near 36-in-thick cake of ice is John Kuhn, manager of construction for Missouri Valley Constructors, Inc.

is to be subjected, influenced certain elements of the pier design. Although normally the low-water river depth may not exceed 10 or 12 ft, the entire 1,350 ft to be spanned is subject to scour which under flood conditions might reach depths of 40 ft below low water, and the main channel might vary in location. The scour threat is accentuated by the constriction of the channel by embankment approaches across overflow land.

Severe ice conditions were expected, but because of the remoteness of the site no reliable data on previous ice conditions were available. Borings indicated characteristic subsurface conditions—20 to 40 ft of sand and sandy clay alluviums, underlain by glacial deposits of variable clays down to depths of 70 to 100 ft, where a sort of hardpan clay with streaks of limestone, lignite, etc., is encountered. Relatively deep foundations were thus indicated.

Study of the many special conditions involved indicated that they could not be met by a conventional type of pier. Deep caisson piers, whether pneumatic or open dredged, would require extensive and varied construction plant. Conventional pile foundation piers constructed with cribs or cofferdams such as have been used for some Missouri River bridges, similarly would require rather extensive plant, including pumps for unwatering cofferdams, equipment for underwater concreting, etc.; and construction would require shifting from one to another type of construction operation.

Studies finally crystallized in the steel pile pier design with piles, wholly

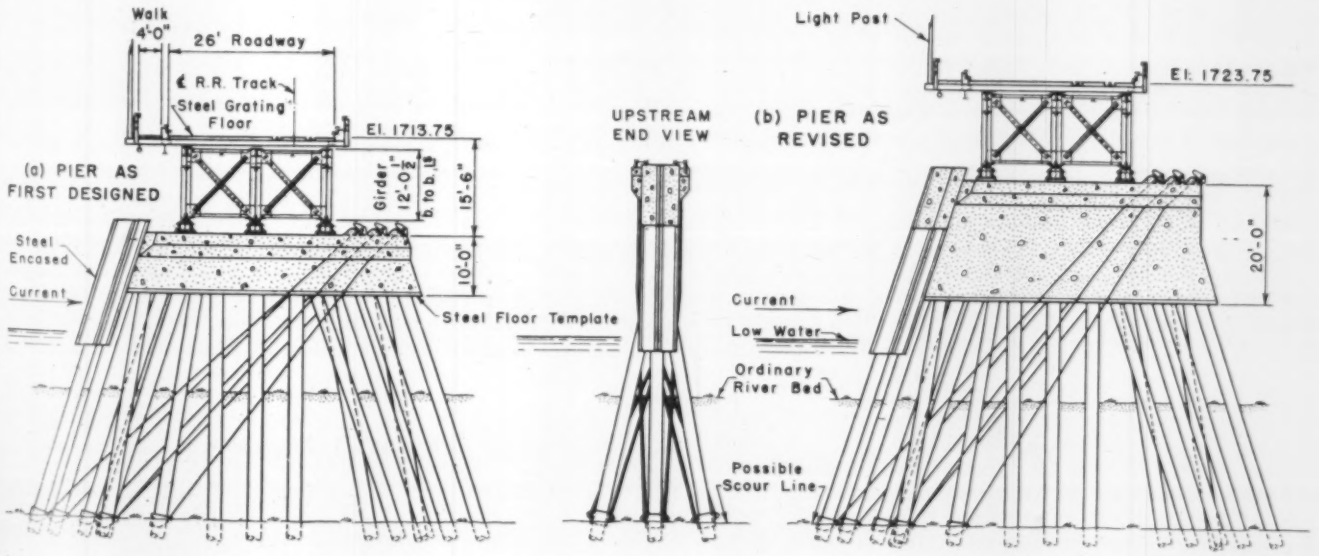
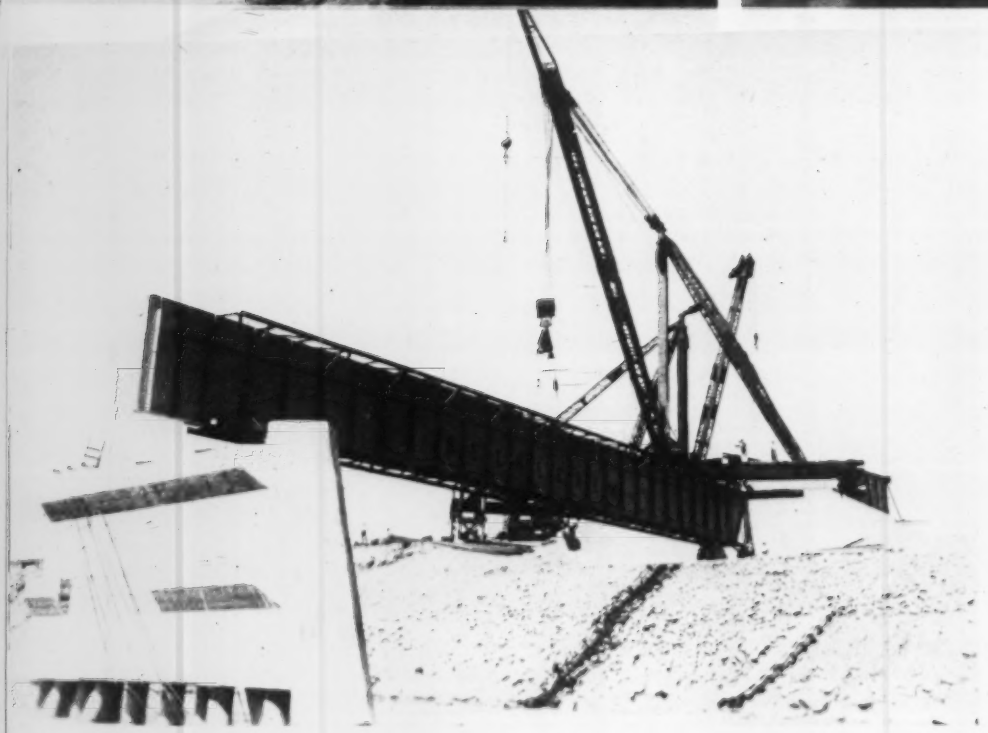



FIG. 1. DRAWING SHOWS details of tubular steel pile pier: (a) as first designed: and (b) as revised to give 10-ft additional height. Two piers completed according to original design, except for cable bracing, withstood extraordinary forces of ice jam in river this spring.



EASE OF REMOVAL and re-use of elements to obtain maximum salvage value after five to six years of service are prime factors considered in selecting girder rather than truss spans for structure. Here, 150-ft girder is swung into place from west abutment to Pier 1. Protrusion of concrete marks original coping and top of pier before extra 10 ft was added.

exposed above water, joined at their tops above ordinary stage by encasement in a reinforced concrete cap beam, in part steel encased. Aside from a small concrete plant, this would require—and did require—but one major piece of contractor's plant, a heavy specially designed floating pile-driver. No pumps, or boilers to run them, no equipment for placing concrete under water, and none of the miscellaneous equipment for caisson pier sinking were needed.

The design necessarily was based upon assumed pile capacities. Experience in driving other steel piles, in some cases tubular piles, elsewhere in the Missouri and Mississippi Rivers, indicated that tubular steel piles could be driven deep enough to be absolutely safe against any scour, to have a normal load capacity of at least 150 tons, and to be safe against occasional material overloads. Since the nearest river gage to this remote site is at Elbowoods, 47 miles upstream, the U.S. Engineers had rather meager data on which to stipulate an elevation for bridge grade and low steel elevation.

### Roadway Grade Raised 10 Ft

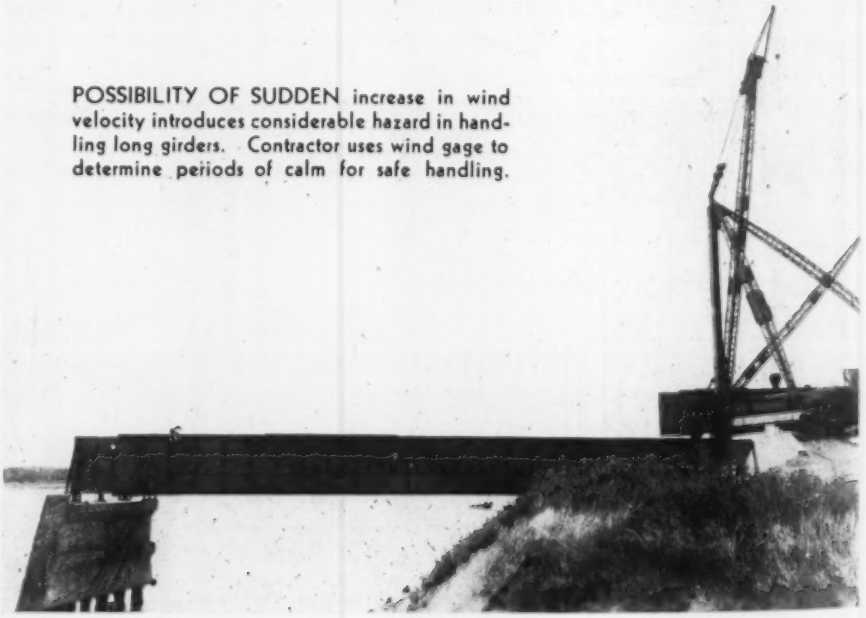
The ice jam experienced this spring demonstrated a need for a higher roadway grade than that of the original design. For a permanent structure a raise of 20 ft or more might have been considered necessary, but after consideration of the various probabilities of such an ice jam occurring at the same place within five years, the facilities for maintenance and control, and other conditions peculiar to this "temporary" bridge, a raise of grade of 10 ft was determined by the U.S. Engineers.

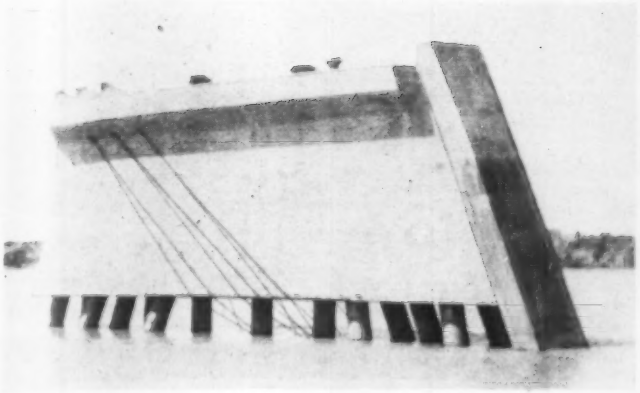
Various studies were made of how best to remodel the abutments and piers of the bridge to make them suitable for the increased height. Completion of the bridge within the working season of the year 1947 was considered urgently necessary to permit other construction operations to move forward according to the broad program. Delays in obtaining materials, or other contingencies that might defer completion until the spring or summer of 1948, were to be avoided if at all possible.

The status of the construction work at the time the revised design was being considered was that Piers 1 and 2 were substantially completed and the footing of the west abutment was built. The contractor had resumed work and pile driving was in progress at Pier 3. All materials required by the original plans were either at the site or were in process of being delivered. Additional concrete materials and reinforcing steel could be secured with sufficient promptness to avoid delay of construction operations. This was not true of the tubular steel foundation piles, or even of the steel H-beam piles. For these, no delivery within less than four months was offered, and even then delivery was contingent and doubtful. Some surplus H-beam piles and a small surplus length of tubular steel piles were on hand.

To keep pile loads within the same range as the original design, it would be necessary (1) to use a greater number of piles or (2) to drive the piles at increased batters. Under either of these conditions the concrete connecting block could be set up to the required 10-ft height. But additional piles could not be secured within the time required and increase of batters would have required very considerable revision in the contractor's special heavy pile driver. Similarly, to set the bottom of the concrete beam at a higher elevation above ordinary water would have required a considerable revision in the special pile driver to enable it to overtop the steel template at its

POSSIBILITY OF SUDDEN increase in wind velocity introduces considerable hazard in handling long girders. Contractor uses wind gage to determine periods of calm for safe handling.





BRACING CABLES on finished pier are drawn taut, ready to function. Originally, cables were not to be tightened until deep scouring occurred, but further consideration determined that cables should be jetted into place and tightened as part of original construction.

higher elevation. The most expeditious revision was to add 10 ft of height to the concrete block and to retain the steel piles and other construction parts as originally planned, provided the piles could be made adequate for the increased loadings.

### Pier Construction Details

Each of the piers consists of a concrete-encased double-trussed cap supported by 15 piles, only three of which are driven vertically (see Fig. 1). Angles of the other piles, driven on a batter of 4 in. horizontal to 12 in. vertical, range from the four driven parallel with the center line of the pier to eight set at an angle of $41\frac{1}{2}$ deg. The $\frac{3}{4}$-in. welded plate, 24-in.-dia piles—at least 100 ft in length—were driven and jetted to a resistance of 150 tons each.

The bottom surface of each pier cap is a steel plate 72 × $\frac{5}{8}$-in. with transverse stiffeners, with a ring-reinforced hole for each pile. This functioned as a template to locate the piles, as bottom form for the concrete, and as supplementary to the bottom chords of the side trusses. Piles are bedded from 3 to 6 ft in the concrete of the pier caps, and are welded to the bottom plate. Open-ended, the piles are reinforced with two $\frac{3}{4}$-in. plate collars for the bottom 2 ft, to provide a cutting edge. Up to about 3 ft below low water, piles were filled with sand; above that elevation, the piles were filled with concrete. The concrete filling was placed as a precaution against damage to the piles from water freezing inside of them.

### Precautions Against Scour

Stability against extraordinary scour is insured by special precautions. A system of $1\frac{1}{8}$-in. (6 × 19) steel wire ropes is connected to six upstream batter piles at the assumed elevation of maximum scour. Extending up through the concrete haunches on the sides of the pier caps, they will be fastened to special cast-steel snubbing anchors set on the top of the piers at the downstream end. These anchors rest on concrete seats cast monolithically with the concrete in the pier caps.

The several calculated loadings as applied to the pile in the extreme position for the original design and for the increased-height design are given in Table I.

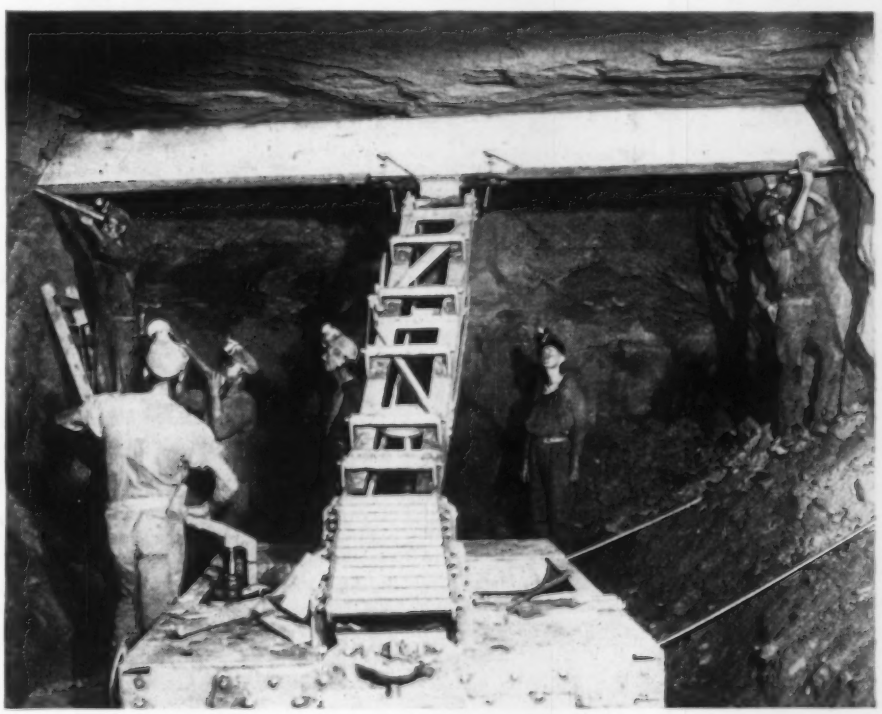
(*Continued on page 76*)

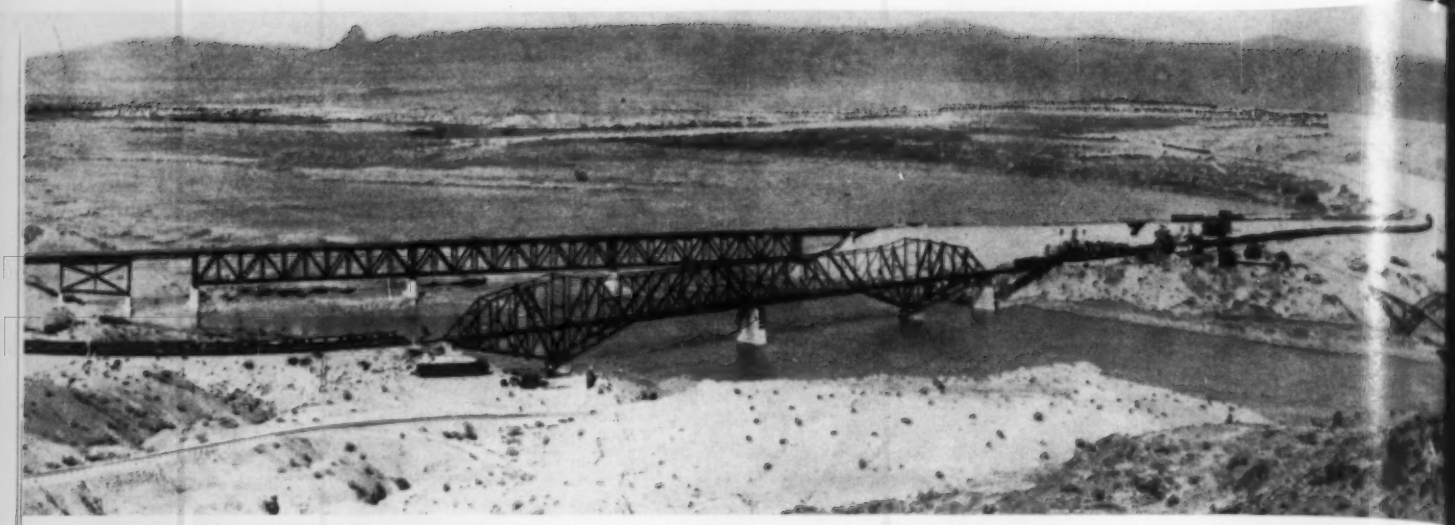
**TABLE I. RECALCULATED PILE LOADINGS**

| Loading | Original | Revised |
|---|---|---|
| Dead load | 37.1 tons | 49.7 tons |
| Dead load, live load | 80.5 tons | 93.0 tons |
| Dead load, live load, 30-lb transverse wind | 119.0 tons | 139.4 tons |
| Dead load, live load and ice | 122.0 tons | 146.2 tons |
| Dead load, live load, 30-lb transverse wind and ice | 160.4 tons | 192.7 tons |
| Dead load, live load and braking | 130.5 tons | 156.0 tons |
| Dead load, live load, 30-lb longitudinal wind | 91.8 tons | 107.2 tons |
| Dead load, live load, 30-lb longitudinal wind and braking | 141.8 tons | 170.2 tons |

## *Truck Simplifies Timber Setting Operation*

TIMBER SETTING TRUCK places heavy cross collar in position in Tennessee Coal, Iron & Railroad Co. mine with ease and safety in 60 percent less time than required by hand methods. Timber is rolled along conveyor and clamped in place in cradle at end of 10-ft boom. Hydraulic hand pump on left side of truck raises boom in about two minutes from 4 ft above track to final position shown in illustration, where cross collar is held until anchored on rib pins. Rachet device prevents boom from dropping in case of trouble with hydraulic system. Cradle can be rotated to any horizontal position. Boom is swung from side to side to assist in placing timbers in desired locations. Timbers weighing up to 900 lb can be set with less effort, smaller crews and greater safety in less time than required by old methods. Machine shown here is at work in ore mine of U.S. Steel Corp. subsidiary in Birmingham, Ala., district.





ALMOST SCRAPPED to alleviate steel shortage during World War II, Red Rock Bridge over Colorado River at Topock, Ariz., has been transformed from railroad to highway bridge, thus eliminating lighter Topock Arch Bridge (span at right of photo). Cantilever structure was strengthened in 1911 by adding channel pier at midpoint of suspended span. New Santa Fe Railroad Bridge is seen in background.

# Converted Railroad Bridge Over Colorado River Carries California-Arizona Highway Traffic

## *Fifty-Five-Year-Old Red Rock Bridge on Santa Fe Line Is Transformed Into Highway Bridge at Cost of $71,500*

R. ROBINSON ROWE, M. ASCE

Senior Bridge Engineer, California Division of Highways, Sacramento, Calif.

HISTORIC RED ROCK BRIDGE, linking its new owner states of Arizona and California over the Colorado River, has once more escaped demolition and is now carrying highway traffic instead of the Santa Fe Railroad traffic for which it was originally designed. Its railway burden has been taken over by a new double-track, deck-type bridge located about 500 ft upstream (see article by Walter E. Robey, M. ASCE, in CIVIL ENGINEERING for September 1947). Once the longest of its kind and now one of the oldest of steel bridges, the Red Rock structure has seen three revisions in its 57-year history. These changes would have been impossible had not design, construction and faithful maintenance preserved the original strength.

NOW OPEN FOR TRAFFIC, 57-year-old Red Rock Bridge across the Colorado River near Topock, Ariz., has been transformed from a railroad to a highway bridge at a cost of $71,500, including supervision and extra work. A 1944 act of Congress (see box insert at lower right) authorizing the bridge's transfer from the Atchison, Topeka and Santa Fe Railroad to the states of Arizona and California completed two years of negotiations during which the principals discussed the economical life of steel, costs of dismantling, alternative routes, grade separations and rights of Indians.

The Red Rock Cantilever Bridge was conceived in one flood and born in another. The 35th Parallel Railroad was completed in 1883 when the Southern Pacific, building eastward, bridged the Colorado River 2.5 miles south of Needles, Calif., to join the westward-bound Atlantic and Pacific Railroad. This bridge was destroyed in the great flood of 1884 and replaced by A & P, then lessors as far west as Barstow.

Lesser floods in 1886–1888 threatened immediately to widen the channel from 1,700 to 7,000 ft and eventually to destroy 6 miles of roadbed stretched diagonally across the overflow bottoms of Mohave Valley. To escape that threat, the new joint owners of the railroad (Atchison, Topeka and Santa Fe Railroad Co. and St. Louis and San Francisco Railroad Co.) decided to abandon 10.2 miles of the original line and build 13.2 miles of revised line via a new bridge site 8 miles farther downstream (Fig. 1).

This strategic site, where the Colorado River leaves the wide overflow bottoms of 26-mile-long Mohave Valley to enter the volcanic Canyon of the Needles, had been explored in 1867 by engineers of the Kansas Pacific and named Red Rock from a conspicuous outcrop on the California bank 600 ft downstream from the line.

The story of the design and construction has been faithfully told,[1]

[1] "Red Rock Cantilever Bridge," S. M. Rowe, S. W. Robinson and Henry H. Quimby, TRANSACTIONS, ASCE, Vol. XXV, 1891, pp. 662 et seq.

***CONGRESS IN DECEMBER 1944 approved transformation of the 55-year-old Red Rock Bridge into a highway bridge in the formal language of the following act (Public Law 537, 78th Congress).***

**"BE IT ENACTED by the Senate and House of Representatives of the United States of America in Congress assembled, That, in order to facilitate interstate commerce, improve the postal service, and provide for military and other purposes, The Atchison, Topeka and Santa Fe Railway Co., or its successors, is hereby authorized to convey to the States of Arizona and California, jointly or separately, the existing railroad bridge and approaches thereto, across the Colorado River, formerly known as the Red Rock bridge, located near Topock, Ariz., which bridge has been or will be superseded by realignment of a portion of The Atchison, Topeka and Santa Fe Railroad and construction upstream from said existing bridge of a new railroad bridge."**

with frank discussion of misjudgment of foundation conditions and a modest account of the careful revision of the plan. As built, its proportions and significant data were:

| | |
|---|---|
| Cost, dollars | 462,434 |
| Gross length, ft | 1,110 |
| Suspended span, ft | 330 |
| Main span, ft | 660 |
| Each anchor arm, ft | 165 |
| Width, center to center of trusses, ft | 25 |
| Width, clear minimum, ft | 20.35 |
| Elevations:[2] deck | 504.4 |
| High-water mark | 457.9 |
| Low water | 426.8 |
| Center of caisson | 366.4 |
| Design live load in kips: | |
| Engines, two at | 188 |
| Trailing, per lin ft | 3 |

The bridge was completed on June 25, 1890. However the old line had washed out on May 9, one day after the new main span was pinned and swung. In a few hours the traveler engine was removed, tracks were laid through the traveler legs and trains rolled unceremoniously over the new route.

### Central Pier Added

For two years (until the Mississippi was spanned at Memphis) the Red Rock Cantilever Bridge was the longest cantilever in the Americas. It was designed for loads so heavy that a full-load test could not be made, but the margin of safety dwindled as locomotives grew. The floor and lateral system were strengthened in 1901, but in 1911 some radical changes had to be made.

After alternatives of relocation and of new superstructure had been considered, a channel pier was added under the midpoint of the suspended span. Since the bridge was no longer a cantilever, that part of the name was dropped. Reversals of stress required extensive reinforcement, particularly of tension members, which were now compressed.

Until 1914 the occasional highway traffic crossed the Colorado River by ferry at Needles, 11 miles north of Red Rock. The destructive flood of that year took out the ferry and left the Arizona approach a 4-mile quagmire. Nearly coincident were the attempted developments of Indian and private lands by new irrigation systems, the gold rush to Oatman and promotion of the National Old Trails Highway. Because of this flood and new traffic demands, the Red Rock Bridge was planked for secondary use as a highway, and maintained as such until a highway bridge could be built.[3]

The Topock Arch Bridge was opened to highway traffic February 20, 1916. Its construction had been financed by the states of Arizona and California, The U.S. Indian Service and the County of San Bernardino (a unit as large as several states). Located 800 ft downstream from the massive Red Rock Bridge and springing from Red Rock itself, it was a delicate companion structure. The story of its erection has already been told.[4] The contract cost was only $75,448 for a two-lane highway bridge spanning 592 ft. For 12 years this portal to California on U.S. Highway 66 was the longest three-hinged arch in the United States.

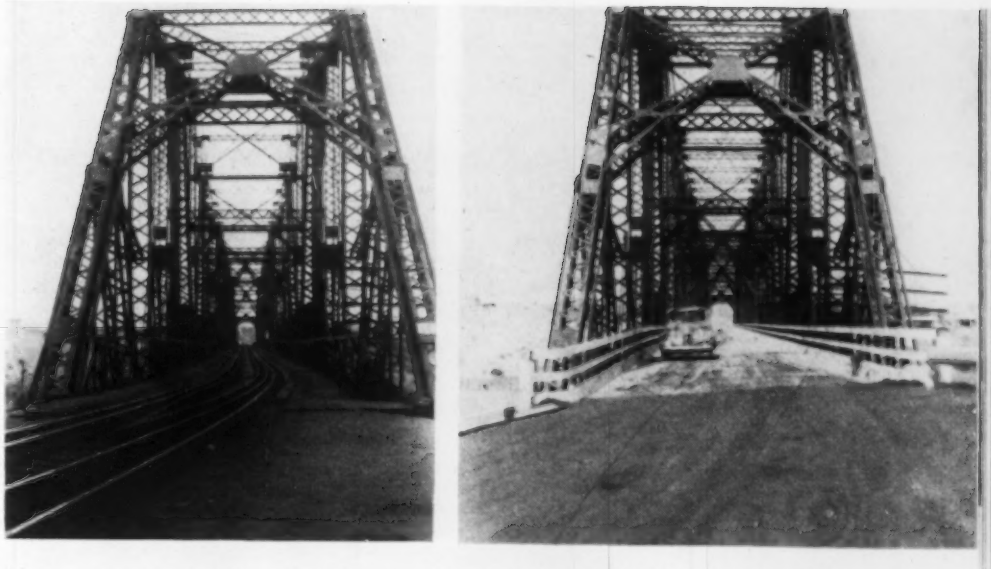
Although of light design for light loads, it had until recently proved adequate for the infrequent traffic characteristic of the area. A weight limit of 11 tons and the injunction "One Way for Trucks and Buses" was not a serious inconvenience. However, wartime transport and desert maneuvers of heavy military equipment found the limitations restrictive.

Another unforeseen element shortened the life of the structure. Closure of Parker Dam on March 4, 1938, created Lake Havasu, backing up water for 45 miles and submerging the abutments and part of the ribs of the bridge. Although protection was applied to steel surfaces before submergence, there is doubt of the future effectiveness of this measure.

The states of Arizona and California, realizing that a change was inevitable, had been studying alternative routes for 8 years. The cost of crossing Mohave Valley has prevented (and may prevent for many years) the development of a more direct line.

### New Railroad Bridge Constructed

The California approach to the Red Rock Bridge was a long 9-deg curve. Never desirable, this curve became unbearable with the speeding up of modern streamlined trains. Double-tracked otherwise, the line was restricted to gauntlet track on the bridge. As a part of a major improvement planned before the war, the Santa Fe Railroad relocated 5 miles of line to a maximum curvature of 1.5 deg and constructed a new bridge 500 ft upstream from Red Rock Bridge.



**BEFORE AND AFTER** views of California portal of Red Rock Bridge show ample width that permitted its conversion to two-lane highway structure. New deck is 7-in. concrete slab, 19 ft wide between curbs, supported on new 14-in. WF, 30-lb beams superimposed on railroad deck steel.

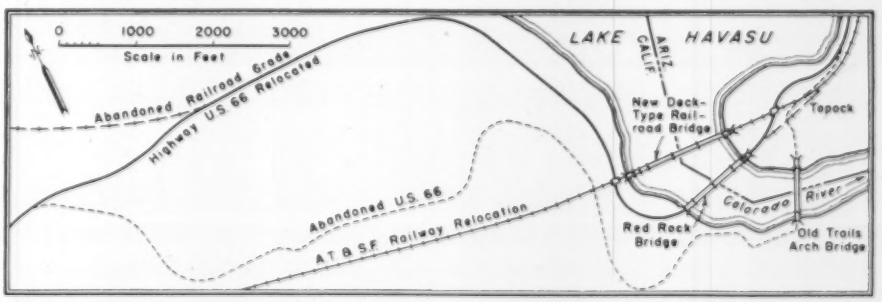



FIG. 1. REROUTING OF U.S. HIGHWAY 66 over 57-year-old Red Rock Bridge relieves light Topock Arch Bridge of increased loads imposed by modern traffic. Location on abandoned railroad grade shortens highway 0.42 mile, eliminates 600 ft of climb and reduces curvature a total of 630 deg of central angle.

[2] Revised to 1929 datum of U.S.C. & G.S.

[3] *Touring Topics*, March 1916, p. 50.

[4] "Erection of Old Trails Bridge over Colorado River," J. A. Sourwine, *Engineering News*, June 1, 1916.

CONSTRUCTION TECHNIQUES and equipment of 1889 contrast sharply with those used on modern construction jobs. View from Vol. XXV (1891) TRANSACTIONS shows sinking of caisson for Red Rock Cantilever Bridge. Description states in part: "On November 21st (1889), air was put onto the caisson and kept on continuously until February 11th, when filling of the caisson was completed, resting on the boulder bed at elevation of 409. The sinking progressed steadily from the first, and the corners did not get out of place to exceed 4 or 5 inches either longitudinally or laterally, during the whole progress of sinking."

This change had been authorized April 20, 1942, upon the condition that Red Rock Bridge be dismantled within 90 days after completion of the new bridge, that the channel piers be razed to the river bed and that the old steel be turned in for scrap, which was then in great demand. In November 1942, when it was first suggested that the States purchase the bridge in place, the railroad expressed a willingness to give it away to avoid the cost of demolition and salvage, but the obligation to contribute to the nation's scrap pile stopped the negotiations.

In March 1943, the Army expressed an interest in the old bridge because the 11-ton limit on the highway bridge was a road block against maneuver of tanks and heavy artillery training in the area for desert warfare. This interest reopened the question of the scrap obligation. It then appeared that the scarcity of scrap would end before the old bridge could be added to the pile, and the way was cleared for new negotiations.

### Railroad Offers Bridge to States

These negotiations led to an offer by the railroad to give the bridge and approach right-of-way to the States to avoid cost of demolition and to reduce cost of grade-separation structures. The States accepted in a three-party agreement covering future operation and maintenance, which was finally executed March 10, 1944, and approved by Congress nine months later.

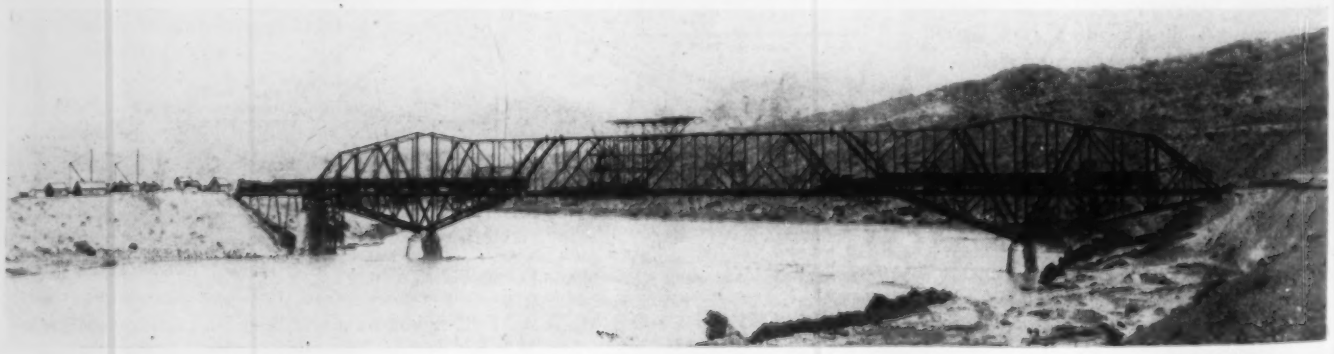
Ordinarily the conversion of a single-track railroad bridge into a highway bridge, not an unusual task, results in a narrow bridge or an expensive job of spreading the trusses. However, the Red Rock Bridge had been built wide to resist lateral forces and this width was sufficient for a two-lane deck without modification of the truss system. Analysis showed that the trusses would carry modern legal-limit highway loads.

### New Deck of Reinforced Concrete

The new deck is designed for H-20 loads and is a 7-in. concrete slab 19 ft wide between curbs, reinforced longitudinally and supported on new 14-in. WF, 30-lb subfloor beams superimposed on the railroad deck steel. A skid rail protects the truss members from damage by collision.

The contract for this deck was let October 6, 1945, to H. L. Royden of Phoenix on his bid of $59,548.50. Work was delayed by scarcity of structural steel and scheduling to avoid hot weather. Old steel exposed in the work was found to be in excellent condition except for tops of stringers. Brine drip from reefers had accumulated on the flanges and caused corrosion to depths of $^3/_8$ in., or halfway through the flange. Since the remaining strength was sufficient for highway loads, these flanges were simply cleaned of corrosion and given a protective coating. The work was completed May 21, 1947, at a total cost of $71,500, including supervision and extra work.

The short Arizona approach was improved by day labor at a cost of $5,000. The California approach, located mostly on the old railroad grade, was 2 miles long. Contract for this work was let March 13, 1947, to Arthur A. Johnson of Laguna Beach on his bid of $70,412. Thus the total cost of the project was $147,000. In addition to provision of a wider and stronger bridge, the road was shortened 0.42 mile, elimi-



FLOOD-STALLED TRAFFIC uses new route few hours after completion of bridge. Old line washed out one day after new span was pinned and swung. Traveler engine was removed and tracks laid through traveler legs to meet emergency.

nating 600 ft of climb, and curvature was reduced a total of 630 deg of central angle. The sharpest curve now has a radius of 410 ft, whereas there were two curves of 130-ft radius at the California end of the former highway bridge.

### Responsible Personnel

Plans for alterations were under the direction of R. A. Hoffman, M. ASCE, engineer of bridges and dams for the Arizona Highway Department. California was represented in discussion of general plans by F. W. Panhorst, Director ASCE, bridge engineer. The bridge contract was supervised by Frank Berg, resident engineer, under the direction of Ed Mays, district engineer of the Arizona Highway Department.

The original Red Rock Cantilever Bridge was built under the direction of Albert A. Robinson, M. ASCE, chief engineer of The Atchison, Topeka and Sante Fe Railway Co., who selected, after competition, the design of Dr. J. A. L. Waddell, Hon. M. ASCE, for the Phoenix Bridge Co. Professor Stillman W. Robinson, M. ASCE, was consulting engineer for the superstructure. Samuel M. Rowe, M. ASCE, was chief engineer at the site, in charge of substructure and erection. The central pier was added and the cantilever transformed into a continuous truss under the direction of A. F. Robinson, M. ASCE, a later chief engineer of the railway.

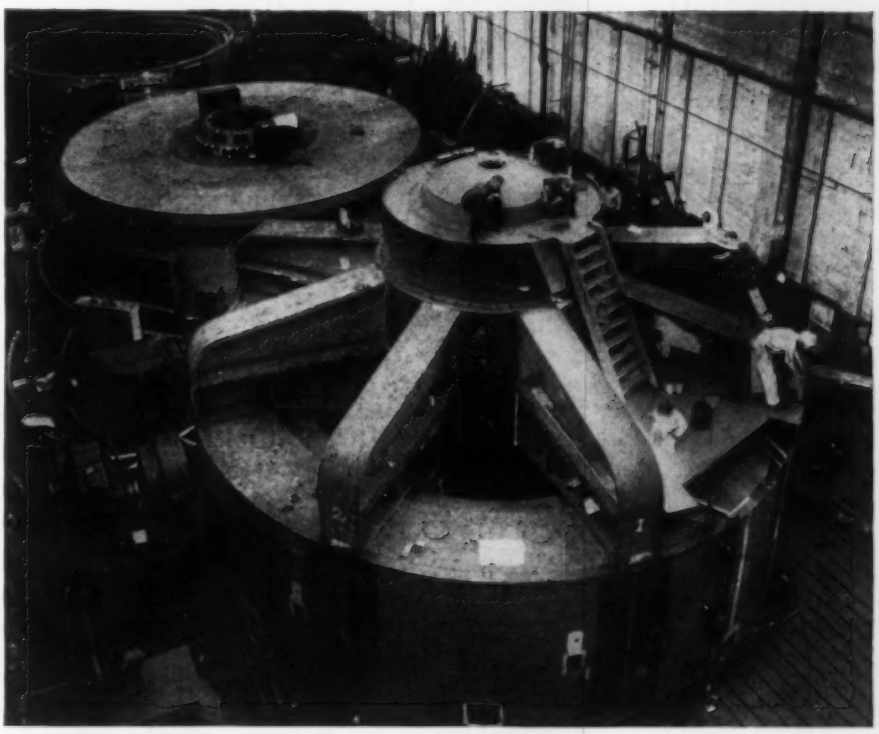
OLD TRAILS ARCH BRIDGE on U.S. Highway 66 over Colorado River—pictured here before Lake Havasu flooded lower hinges—is relieved of heavy traffic load by reconversion of Red Rock Bridge, 800 ft upstream. For 12 years after completion in 1916, structure was longest three-hinged arch bridge in U.S.

# New 108,000-kw Generator for Grand Coulee

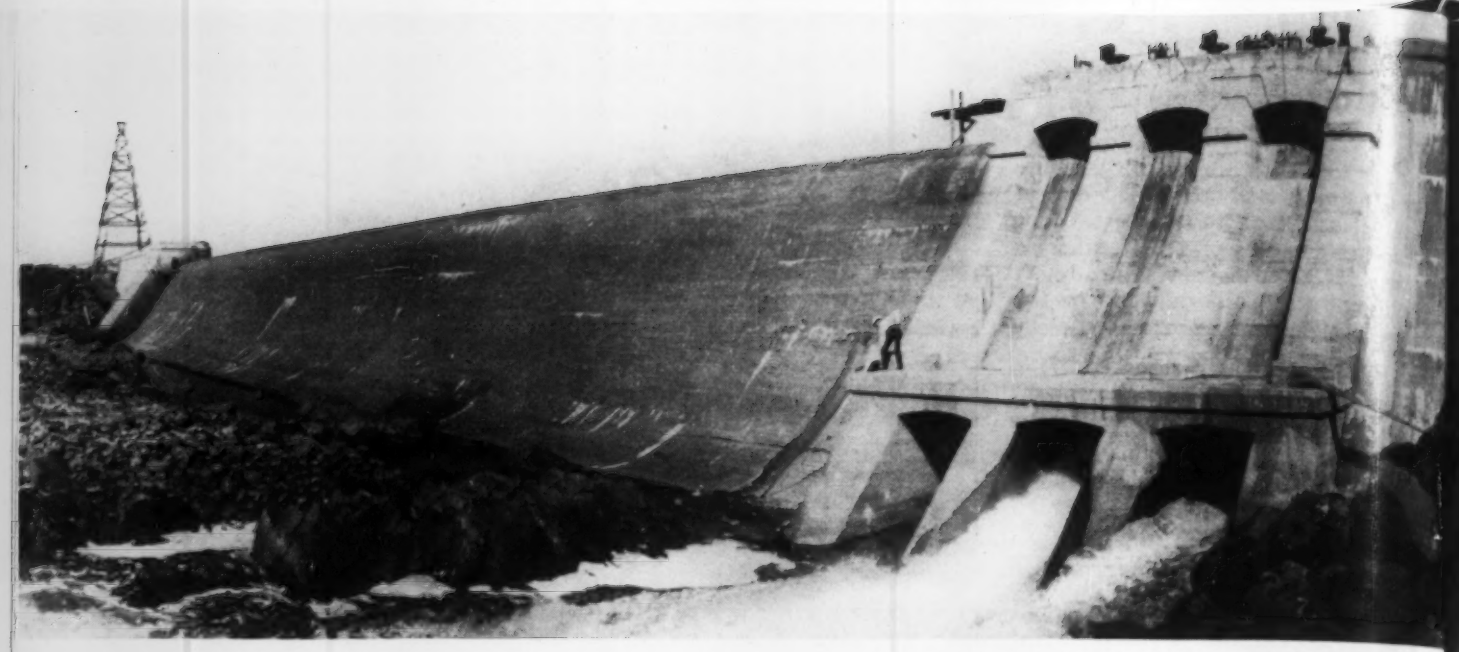
A NEW 108,000-KW GENERATOR as big as a six-room house has been completed by Westinghouse Electric Corp. for installation at Grand Coulee Dam, where it will increase generating capacity by the equivalent of 146,000 hp. This new giant and six similar machines already installed—the world's largest waterwheel generators—could supply power for all the industrial and residential requirements of a city twice the size of Pittsburgh.

Eventually the Grand Coulee program calls for 18 waterwheel generators, each of 108,000-kw capacity. This tremendous concentration of energy will be used for pumping irrigation water to 1,200,000 acres of arid farm land in the Columbia Basin of central Washington and will set up a huge reservoir of electric power for industrial use in the West.

Completion of the 238-ton stator was the final step in the manufacturing job. Other parts of the generator, including a 72-ton steel shaft 32 ft long, and a 464-ton rotor, already have been shipped. The generator is being assembled at Grand Coulee and is expected to go into operation early in 1948. Into its construction went approximately 750 tons of steel and more than 100 miles of copper wire.



ONE OF SIX SUCH POWER GIANTS now installed at Grand Coulee Dam, 108,000-kw generator (above) is similar to seventh unit just completed by Westinghouse Electric Corp. and shipped in sections for assembly at dam. Machines, weighing 2,000,000 lb and measuring 45 ft in diameter and 32 ft in height, are largest waterwheel generators ever built. New generating unit increases installed capacity at Grand Coulee Dam by 146,000 hp and sets up huge reservoir of electric power for industrial use in West.



# Restoration Work Prolongs Life of Concrete Structures

A. C. GIESECKE, Assoc. M. ASCE

Hydraulic Engineer, Minnesota Power & Light Co., Duluth, Minn.

RECENT INSPECTION OF twelve concrete hydroelectric plants of the Minnesota Light & Power Co. indicates general excellence of results achieved in restoration work over the past 20 years. During this period about 75 percent of the total estimated amount of renovation required has been accomplished. The balance of the work is expected to take another five years. Five of the twelve hydro plants account for 90 percent of the restoration costs; one of these is the 24-year-old Winton plant. At five years of age it was in great need of the extensive renovation applied 19 years ago, and now is in particularly good condition. One of the other seven, the 42-year-old Thomson plant, stands today as originally built, as a fine example of virtually perfect concrete. Restoration methods used in this work are outlined here by the author.

THOMSON DAM constructed in 1906 has made best showing of twelve hydroelectric plants in Minnesota Power & Light Co.'s system. Its longevity is attributed to development of proper concrete mix in laboratory, and to dry consistency of concrete when placed. Structure is used as criterion for judging concrete in other plants in system.

SEVEN HYDROELECTRIC stations owned by Minnesota Power & Light are located on streams that contribute water to the Mississippi; four are on streams that contribute to the Great Lakes and one on a stream that flows into Hudson Bay. The elevation of the region is moderate (600 to 1,500 ft) and thus contributes little to the severe winter climate.

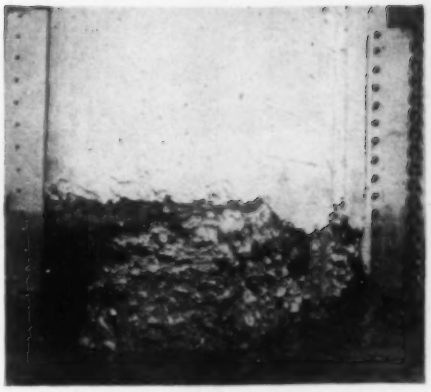
In its latitude of 47 deg north, the region enjoys no Chinook winter periods or benefits of warm off-ocean

SURFACE INCRUSTATION of concrete in Thomson Dam (below) gives superficial appearance of serious disintegration, but concrete underneath is found to be in excellent condition. Scale formed on dam (right) is of no structural importance.

The Minnesota Power & Light Co. serves northeastern Minnesota with no interconnections except those to its subsidiary, Superior Water, Light & Power Co., serving Superior, Wis. This system is served by twelve hydro and five steam electric plants, comprising 95,036 kw hydro and 78,850 kw steam. Important additions to both are under construction (see Table I).

TABLE I. DATA ON COMBINED MINNESOTA-SUPERIOR SYSTEM

| | Present | Under Construction | Total on Completion |
|---|---|---|---|
| Hydro | 95,036 | 12,000 | 107,036 |
| Steam | 73,850 | 33,000 | 106,850 |
| Total | 168,886 | 45,000 | 213,886 |



BADLY DISINTEGRATED concrete in Winton Dam, five years after construction, indicates use of mix inferior in quality to that used in Thomson Dam 16 years earlier.

EARTH AND CLAY fill seal placed against upstream face of Winton Dam is part of 1928 restoration work. Fill and restored concrete are in good shape 19 years later.

breezes. Normal mean temperature of each month for November through March is below 32 deg F. A month with a mean temperature below zero occurs about once in 10 years. The coldest month on record in 76 years was January 1912 with a mean temperature of 7.2 deg below zero. Periods of continuous below-freezing temperature of about 30 to 60 days' duration occur each winter.

Thus, with a low-angle winter's sun, concrete in this region is subjected to relatively few cycles of freezing and thawing. Most exposed surfaces of the company's dams are shaded from even the feeble warmth of the winter sun. Under such conditions frost penetrates deeply. An extreme case is cited in which ice formed on the water side of a gravity dam where the concrete was 6 ft thick.

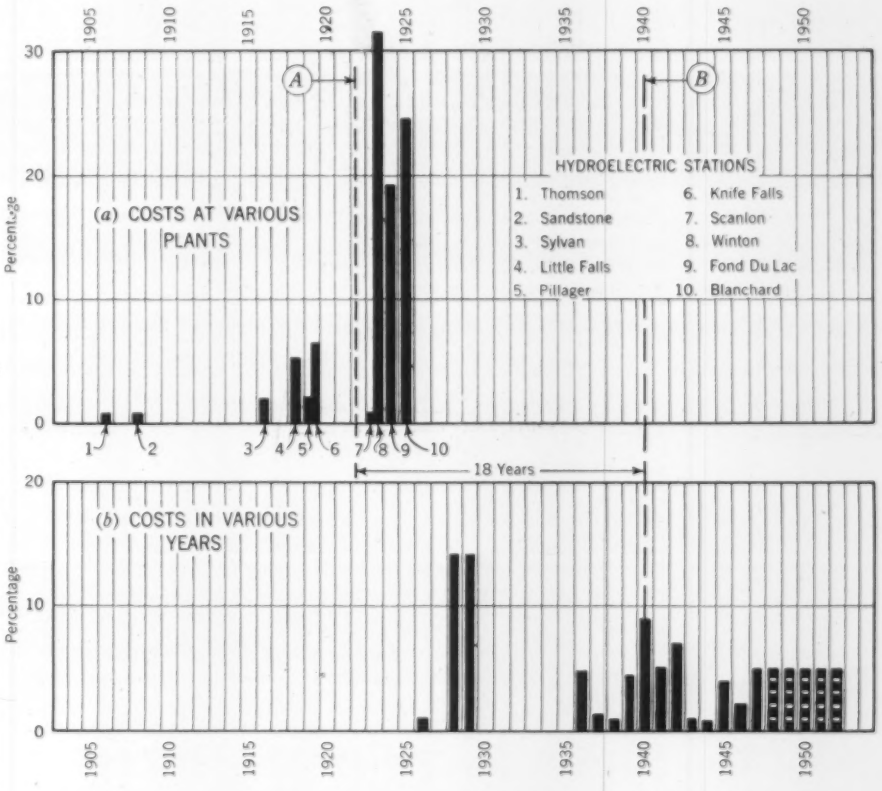
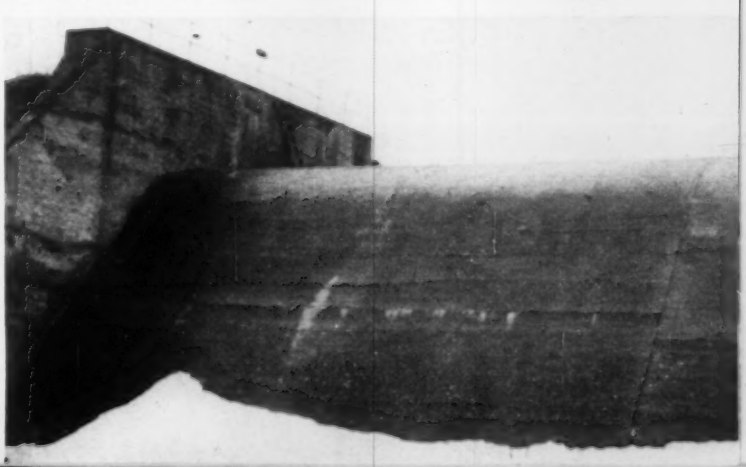
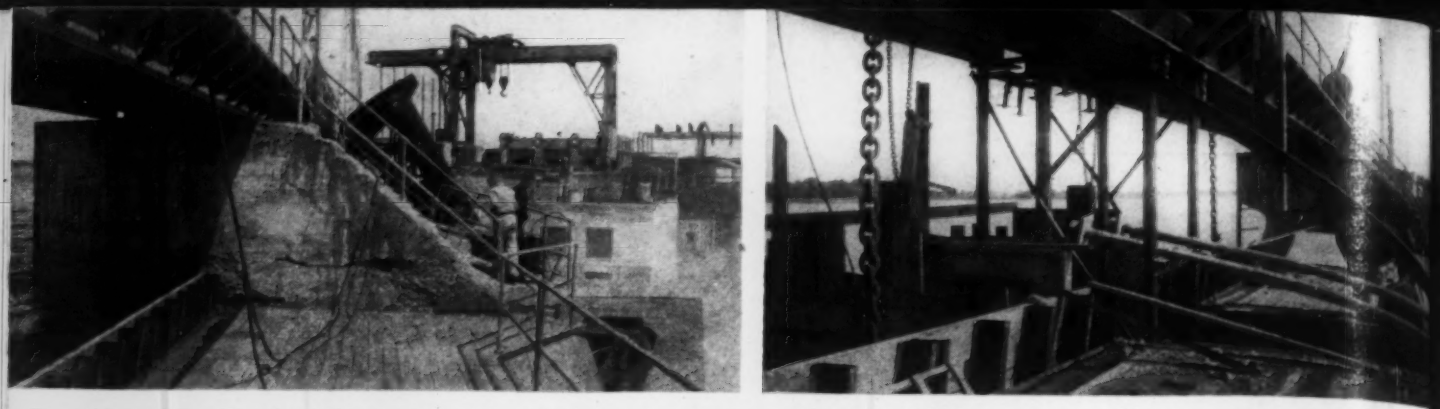


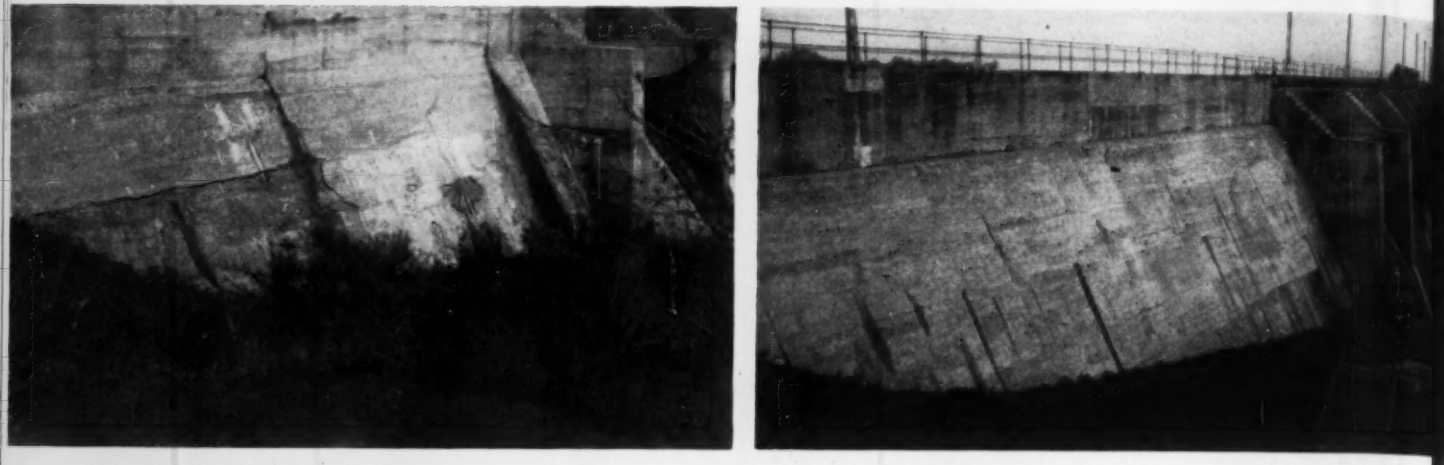

FIG. 1. GRAPHS SHOW: (*a*) Restoration costs for each of ten hydroelectric plants, in percentage of total cost; and (*b*) years in which restoration costs—plotted in terms of percentage—were incurred, with estimated costs projected to 1952.

DOWNSTREAM FACE of ogee section of Winton Dam in badly disintegrated condition (below, left) prior to restoration work in 1928–1929 is in good condition (below, right) 19 years later. Restoration work consisted of chipping defective material to depths of 6 in. minimum to 4 ft 6 in. maximum, setting drain ducts in deep slots where seepage was in evidence, and placing new concrete mat to form new surface 2 ft beyond original face of dam. Mat, heavily reinforced, is dowel-anchored to original concrete.

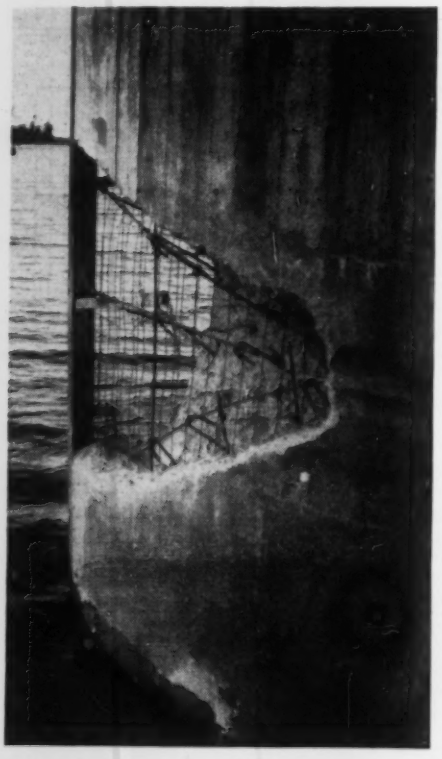




GATE PIER at Blanchard Dam, constructed of sloppy mix placed by means of chutes in 1925, is in bad condition 13 years later (above, left). Restoration work in 1939 (above, right) consisted of reducing load on 14×44-ft Tainter gates by dropping water level 5 ft and setting barnacle cofferdam on nose of pier. Top of old pier was removed and new concrete was placed to re-imbed Tainter gate-hinge support rods (two 4-in. rods with heavy nuts and washers). Subsequent bites replaced, block by block, old concrete with new.



SPALLING OF CONCRETE on downstream face of gravity section (above, left) calls for restoration work 13 years after construction of Blanchard Dam. Recent view (above, right) shows excellent condition of 24-in.-thick concrete facing placed in 1941. Experimental portion of mat constructed 18 in. thick is in much less satisfactory condition than 24-in. facing.



PIER RESTORATION work at Blanchard Dam in 1939 consisted of setting numerous dowels in holes sloping so as to be filled with soft grout. Wire mesh was used to supplement rods in smaller areas.

A pronounced ice formation was also found on the water side of a wheel pit wall $4^1/_2$ ft thick.

### Scope of Problem

Extent of the work involved in restoration of ten of the twelve dams at various plants of the Minnesota Power and Light Co. is given in Fig. 1. This graph shows the restoration cost to date plus the estimated cost of work now contemplated. Data on two other dams are omitted from the graph as being relatively unimportant. For purposes of comparison it may be assumed that all ten of the plants are of the same relative size and are subject to the same conditions. All have moderately high (20 to 60-ft) gravity-section dams at which no opportunity occurs for work on water faces during seasons of low water levels. From the chart it is clear that Dams 4, 6, 8, 9, and 10 comprise the major part of the restoration problem.

Restoration methods used over the past 20 years are reasonably effective. During this period about 75 per cent of the work required to overcome structural deficiencies has been accomplished. Combining the costs of this work with estimates of future work gives a fairly firm picture of the total cost used in Fig. 1(*a*).

The chart, Fig. 1(*a*), indicates that the three oldest dams are in the best condition and that the three youngest are in the worst condition—actually in a class by themselves. Of the three oldest dams the very oldest, the Thomson plant, makes the best showing. It serves as ample proof that the art of making good concrete was known before the five problem stations were built. Was concrete of 1906 an art that was lost at a later date? Fortunately the record of this fine old structure that has been capable of enduring a severe climate is available. It was written by H. C. Ash and discussed by M. B. Lagaard, M. ASCE, of the Portland Cement Association in Vol. 25, 1929, *Journal of the American Concrete Institute*.

In his report Mr. Lagaard states, "In observing the structure for the first time, the general impression gained is that certain portions are in excellent condition, while others are in a somewhat advanced stage of disintegration. Under closer examination, however, it is developed that much apparent disintegration is in reality a localized incrustation and scale of no structural importance.

Underneath this scaly deposit, as well as in all other portions of those structures except at the fill planes, the concrete is in excellent condition. In the exception noted, the concrete is spalled slightly in places, probably due to the freezing of water which has entered these seams. However, there is no evidence of laitance at these points."

Thomson concrete of dry consistency was placed by cableway; Mr. Ash says, "like that of thick mush" and great care was taken to use an exact amount of mixing water for each batch. The design was developed in the laboratory by testing a great number of short unreinforced beams. So certainly the art of building concrete good enough for this climate was available when later the poor quality work was done. On the basis of the thorough studies that have been made there can be no denying that we have concrete problems. Fortunately not all our plants present such problems.

### The Restoration Program

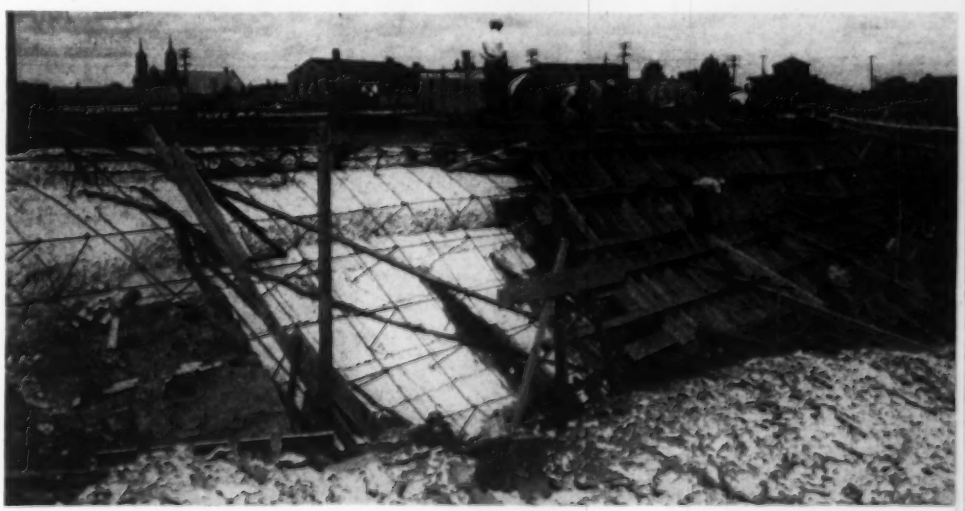
Of the five problem plants previously mentioned, the three having the largest restoration costs were built by individuals who were far enough removed geographically as to have no influence or effect on one another's work. Figure 1 shows that the poorer structurers were built in 1918, 1919, 1923, 1924, and 1925. These were the days of World War I, or its aftermath, when we indulged in the slogan of "Concrete for Permanence" (a form of whistling in the dark, perhaps), when the cry was "hurry—hurry build the plant." They were the days of tall hoist towers and long spider webs of cables and of long chutes for pouring concrete. In Fig. 1(*a*), the symbol marked *A* at 1922 marks the average birthday of our five problem plants.

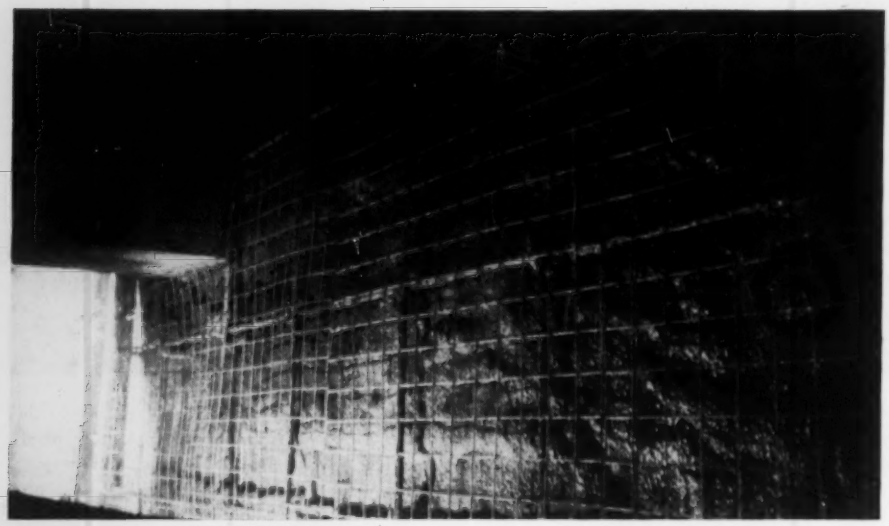
In 1926 on a project then eight years old, the Minnesota Power & Light Co. undertook its first concrete restoration work. Another major restoration job was begun in 1928 on a plant then but five years old. In Fig. 1(*b*) restoration costs are plotted in terms of percentage in the years in which they were incurred. The chart shows also proposed costs to 1952, at which time our present plans call for virtual completion of restoration work. The past and estimated future costs, as given in Fig. 1(*b*), were used as a basis for spotting "*B*" at the year 1940, the average date of restoration. With confidence it is expected that after 1952 we shall see:

1. Thomson standing intact with but little, if any, need of attention.

MAJOR AREAS of downstream face of Fond du Lac Dam renovated in 1940 (above) when structure was 16 years old are in excellent condition seven years later (below). Signs of disintegration of Tainter gate waterways and gate piers were seen as early as 1928 when dam was but four years old. Comparison of concrete in Fond du Lac Dam with that in Thomson Dam—18 years older—indicates observance of higher standards in construction of the older structure. In view above, concrete is placed in center section by means of chutes while forms for area at left are readied. Forms have been removed from section at extreme right.

RESTORATION OF CONCRETE in Little Falls Dam (below), constructed in 1918 when watchword was speed, is necessary 18 years later. Eleven years of service have proved restoration work sound.





INSIDE FACE of open wheel pits at Knife Falls Plant is relined by guniting. Constructed in 1919 and restored in 1931, plant is today in satisfactory condition. Original walls, 4 ft thick, built largely of slate rock as coarse aggregate, were rapidly approaching failure when pit lining was placed in 1931. Without gunite lining walls would have had life of possibly 15 years, but are now 28 years old and still in good condition.

2. The five problem plants, at 30 years of age, definitely under control, with the average restoration work having occurred when they were 18 years old.

3. That the cost of restoration work was not overly burdensome.

4. That the period of useful life of these structures lies indefinitely ahead.

The primary faults committed in the construction of the faulty projects are those associated with attempts to lower costs. In some cases unwashed bank-run concrete aggregate was used. At times probably not enough cement was used; and, again in the interest of low cost and great speed, chute distribution was used with its implication of excessive water to make the "soup" flow. In round numbers, the principal detriments to quality work were:

(*a*) In three of the five problem projects—bad aggregate.

(*b*) In one of the five problem projects—too much water and segregation.

(*c*) In one of the five problem projects—combination in more moderate degree of all these faults.

In striving to solve each item on the basis of its individual characteristics, the following expedients have been successfully used:

1. Earthfill on both downstream and upstream faces of defective gravity structures and also on thin arch dams.

2. Gunite on the water face of wheel-pit walls.

3. Steel plate facing on gate and tailrace piers.

4. Heavy slab of reinforced concrete deeply doweled into old mass concrete beyond possibility of frost

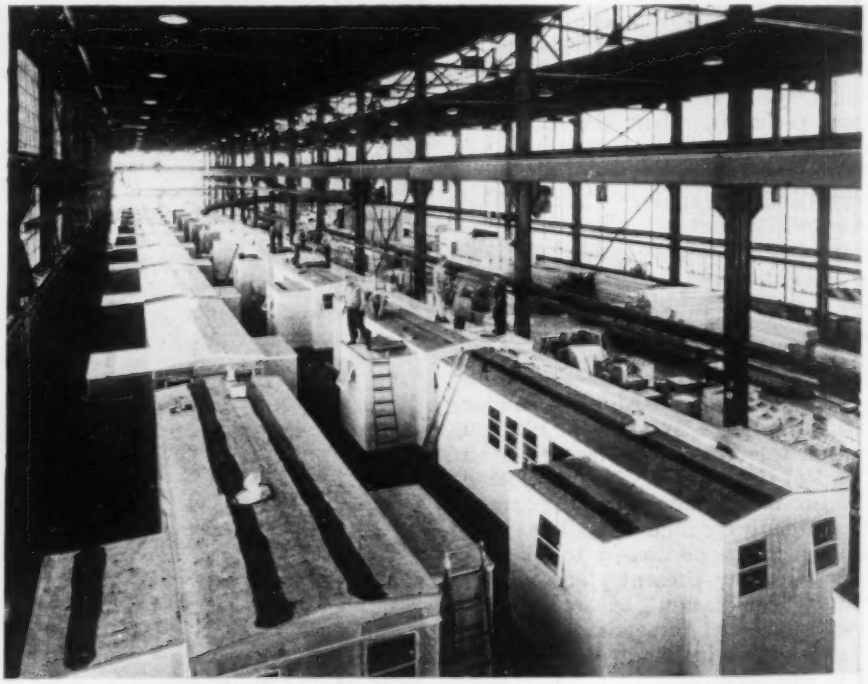
(*Continued on page 74*)

## *Assembly Line Produces House an Hour*

AUTOMOTIVE MASS PRODUCTION methods are now being copied in the manufacture of single- or double-bedroom portable houses equipped with bath and kitchen fixtures, built-in partitions, beds, cabinets and closets, ready for delivery by truck or rail to a home site. Delivered house—priced at $2,650 at Wingfoot Homes, Inc. plant, Washington Park, Ill.—can be erected in four hours ready for immediate occupancy.

The quarter-mile-long production line traverses three separate buildings of a reconverted wartime valve factory. The technique employed was developed after two years of pilot operations in the original Wingfoot factory located at Litchfield Park, Ariz.

There is no backtracking of materials. Partial or subassembly sections move forward on dollies along the production-line rails. Overhead cranes are utilized for lifting floor units and side assemblies and for setting roofs in place. Heavy fork-lift trucks move the finished 3-ton houses to flatcars or trucks. More than 52 homes are in various stages of erection at one time.



WORLD'S LONGEST PRODUCTION LINE for the fabrication and assembly of houses employs approximately 1,100 workers on a three-shift basis to produce from 24 to 30 houses a day at the Wingfoot Homes, Inc., plant in Washington Park, Ill. Raw materials leaving mill room travel continuously forward until they emerge 24 hours later in fully equipped portable house.

DEVELOPMENT PLANS of national, state and local agencies are considered in preparing 30-year program for New Jersey highways. Pictured here, electric power shovel, 5-yd capacity, excavates site for overpass bridge at intersection of Routes S3 and 17. Power is supplied by oil-encased cables seen in left foreground.

# Broad Aspects of Highway Planning Affect Nation's Economic, Cultural and Social Life

CHARLES M. NOBLE, M. ASCE

State Highway Engineer, New Jersey State Highway Department, Trenton, N.J.

IN THIS ARTICLE the scope and broad objectives of highway planning are outlined. No attempt is made to cover all the objectives of a modern highway planning organization. After a broad program has been established it is still necessary to determine the type, general design features and character of each new facility and to execute each project economically but in a manner consistent with the necessity to serve state-wide and local transportation needs effectively. This phase of planning requires a direct application of traffic data, economic analysis and consideration of future growth trends. Only the surface has been scratched in utilizing the tools made available by modern highway planning methods. An inadequate, poorly planned highway transportation system blights commerce and industry, deteriorates residential and recreational areas, induces a decline in tax ratables, and causes a flight of population and industry to areas rendered more attractive and prosperous by suitable highway transportation facilities. On the other hand, an adequate well-planned system of modern design injects renewed vitality into the state and assures continued growth and development and a high standard of living for the people. The stakes are too high to risk the use of hit-or-miss methods in planning highway transportation facilities.

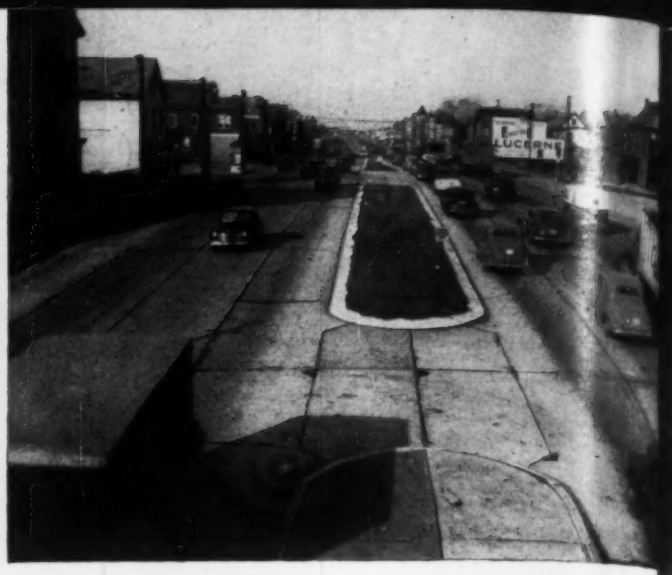
SOUND HIGHWAY PLANNING is of preeminent importance in the entire governmental structure from top to bottom because of the intimate and profound effect of the highway system on the economic, cultural and social life of America. Probably no single factor has had such a significant influence on the American way of life and thought as the motor vehicle and the highway system of America. This combination has wrought a complete revolution in America which has occurred since the turn of the century, more particularly since the close of World War I in 1918. A complete revolution in thought, customs, culture, business methods and social values in 30 years! Viewed historically this is an astounding phenomenon.

The past 30 years have witnessed the rapid and magical development of the motor vehicle to a state of near perfection and the creation from a standing start of a national system of highways to such effect that the economy of the United States is irrevocably geared to motor transport. Transportation is the keystone in modern civilization, and highway transportation is an essential and increasingly important element in the economic well-being and standard of living in America. The motor car, bus and truck are inevitably interwoven with the destiny of the United States, for if motor transport came to a stop overnight the American way of life as we understand it would cease abruptly.

Advance planning won the war just concluded. One reason it required nearly two years before the

MARGINAL ROADS on either side of Route S3, modified freeway under construction in New Jersey, are designed for use of local or short-haul traffic. Equipment used on grading operations for Ridge Road overpass near Rutherford includes 16-yd bottom-dump earthmoving units seen in right foreground.

HEAVY WEEK-END TRAFFIC—as high as 51,000 cars per day—on Victory Bridge (N.J. Route 4) over Raritan River at Perth Amboy is typical of problem confronting New Jersey highway designers in their effort to provide adequate highway facilities. Construction of Edision Memorial Bridge (Route 35) did much to relieve congestion at this point.



CAPACITY OF EIGHT-LANE traffic facility—N.J. Route 25 (U.S 1) is limited by cross traffic at grade, left turns, stop lights, pedestrians, parking, traffic weaving over four lanes, and marginal friction caused by commercial and industrial roadside development. Completion of Route 100 freeway will divert large number of 66,000 motor vehicles using this highway daily.

United States could hit back at the enemy effectively and take the offensive was the absence, at the time of Pearl Harbor, of such planning on the production front on a scale required by total war. Advance planning on the peacetime front in every phase of our national life is just as essential as wartime planning, and this applies particularly to the development of an adequate and economically essential highway transportation system.

Early in the development of the motor age, highway planning was comparatively simple, for the need to connect centers of population with passable roads through the rural areas was obvious, and instinctive engineering judgment was adequate to meet and promote the development of the motor car. That this task was well done is attested by the great highway network which stretches from the Atlantic to the Pacific and from the Mexican border to Canada and which is a tribute to American engineering genius.

But as motor transport integrated itself with American life and industry, the problem became more complex until today the instinctive approach will suffice no longer and more analytical methods are required in order that the highway transportation system may pace the tempo of industrial and social development. Thus it is vital that the continued development and expansion of this system should be wisely, carefully and scientifically planned, utilizing all available data.

Today the highway network is made up of three general groups: (1) The feeder system; (2) the ordinary

SEAGOING DREDGE removes salt marsh muck along Route 100 freeway alignment to depths of 13 to 20 ft at Woodbridge, N.J. Spoil pumped into diked areas is used as fill material to build up swamplands on either side of freeway. Fill and pavement for Woodbridge Avenue, main thoroughfare running diagonally across picture, were restored after dredge worked its way in (to section now backfilled in foreground) and again on its return. (Photograph by Ostergaard, courtesy S. J. Groves & Sons)

state highway system; and (3) the freeway and parkway system. The first system consists of roads and streets which are purely local in function and which serve to collect and diffuse traffic. These roads serve the land directly.

The second, or ordinary state highway system, collects the traffic from the feeder system and carries the great burden of traffic between centers of population. In addition it serves the land along its borders, since free access is permitted adjacent landowners. Such highways are not entirely local; they are of statewide significance and in fact many of them are of national import.

The third system (freeways and parkways) consists of limited-access highways. It serves as the relief valve for congestion. These highways do not serve the land directly since free access to them is denied abutting property owners except at specially designed traffic interchanges. The justification for them is brought about by intolerable congestion and delay on land service highways, where freedom of movement is greatly reduced by high traffic density coupled with costly and nerve-racking delays occasioned by red lights, intersections at grade, and disturbances caused by vehicles entering and leaving the highway at will between intersections to patronize roadside establishments. The most pressing application of the freeway and parkway principle is in highly developed and industrialized urban areas where traffic congestion is strangling further development.

### Aim Is Economic Vitality

Modern highway planning contemplates the proper development, balance and coordination of these three highway groups at the national, state and local level. The end product of this planning is the economic vitality and health of the countryside, the community, the state and the nation as a whole.

The birth of modern highway planning was initiated some ten years ago by the Federal Public Roads Administration and led to the organization of State Highway Planning Surveys. These surveys were the first step and consisted of the collection of highway statistics including traffic volume counts and lately traffic origin and destination surveys. The mere collection of these statistical data is insufficient to produce practical results for it is necessary for the information to be analyzed and then applied to the practical problems associated with highway system planning, design and construction. Thus it is necessary not only to collect highway statistical data but also to apply it intelligently in order to meet the demands of modern highway planning.

DIKED AREA along Route 100 (above) receives spoil pumped by hydraulic dredge working in same location as seen in view at bottom of preceding page (far end of channel). (Photograph by Ostergaard, courtesy S. J. Groves & Sons)

HYDRAULIC DREDGE LYONS, with 20-in. discharge, pumps as much as 20,000 cu yd per day in removing 500,000 cu yd of salt marsh muck along freeway alignment.

### New Jersey Has Highway Planning Bureaus

The New Jersey State Highway Department, in recognition of the change in emphasis in highway transportation and of the fact that highway planning has come of age, has organized a Division of Planning and Economics headed by a director and deputy and composed of two principal bureaus: (1) The Bureau of Planning and Economics, and (2) the Bureau of Planning Survey. The latter bureau gathers highway planning (traffic) data in the field and collates them; the former analyzes the information and applies it to practical highway planning problems having due regard for the principles of economics.

The first broad objective of modern highway planning contemplates the blueprinting of an over-all state-wide highway transportation system which will be required by the state to assure its economic vigor, health and continued progressive development, looking forward to a reasonable period in the future. In the State of New Jersey the system is being developed on a 30-year basis. To accomplish this task

STRAWBERRY HILL borrow pit (above, left) furnishes nearly 500,000 cu yd of fill for Route 100 freeway at daily capacities of over 8,500 cu yd. Fill is placed in 6-in. layers (above, right) and thoroughly compacted with 15-ton sheepsfoot tamping rollers drawn by diesel tractors. Unit in foreground mounts rear tires 21 in. in diameter.

it is necessary to gather data from national, state and local agencies in order to integrate the development plans of these groups with the highway net. It is necessary to learn the trend of industrial and agricultural development, to ascertain where water power and water supply reservoirs, airfields, canals, railways, recreation areas, state and national forests and military installations are planned in order that the highway system may serve these facilities effectively and not conflict with them. It is also essential that the plans of local planning bodies be kept on file and reviewed so that there will be complete coordination through all levels of government from top to bottom.

In determining the location and extent of highway facilities it is advisable to cut cross sections through traffic sheds and compare existing traffic volume with the number of traffic lanes presently available, thus establishing whether there is a current deficiency or adequacy of traffic capacity. The traffic volumes may then be projected ahead 30 years and the number of traffic lanes needed at the end of that period determined. With these data, present deficiencies in traffic capacity are indicated and plans can be made to provide construction to meet these needs. At the same time suitable routes can be laid out to care for future requirements.

In the development of a state-wide long-range plan, consideration should also be given to opening up undeveloped areas for growth and recreation. Consequently it is necessary to take stock of highway construction and maintenance needs and to relate these needs to anticipated revenues in order to determine whether such revenues will be sufficient to meet requirements as rapidly as required by expanding traffic or whether additional motor-vehicle taxes or possibly a bond issue is required.

### Construction Is Part of Master Plan

On the completion of the long-range 30-year plan conceived on a realistic basis of actual state need, a definite goal of accomplishment is established, based on a thoughtful, reasoned analysis of all the factual data available. Actual construction can then proceed with the assurance that it forms a part of the ultimate master plan. This results in over-all economy, avoidance of duplication and costly scrapping of expensive highway facilities.

It must be recognized that the construction of a new highway results in removing tax ratables from the books, divides land areas up into new and often unusable or uneconomical parcels, and causes a major readjustment on the part of property owners. Therefore it is essential that the highway should be properly located once and for all so that this readjustment need take place only once. The whole process requires careful consideration of the principles of broad economics at every level of the state structure.

With the ultimate goal blueprinted, it is then necessary to establish priorities for the actual construction based on factual data and having due regard for anticipated available funds. In order to utilize engineering personnel effectively to perform field surveys, prepare plans and specifications and plan construction operations, it is the purpose of the New Jersey State Highway Department to establish these priorities five years in advance. In this way planning for actual construction can be kept continuously five years ahead and schedules (time tables) can be worked up so that the program will be executed smoothly.

Inasmuch as the work of the New Jersey State Highway Department is carried forward on a fiscal-year basis, it is necessary to prepare a yearly budgetary statement for consideration by the state budget commissioner, approval by the governor and submission to the legislature for final approval and action. The projects included in the budget for state highway construction can be selected in the order of priority from the five-year highway priority list.

### Equitable Distribution of Taxes

Necessary planning responsibilities are the setting up of an annual program for the replacement of worn-out pavements and other physical units in the highway structure, and the establishing of a fiscal program for the rectification of traffic hazards on a priority basis. The use of highway planning data is fundamental in developing these programs.

One of the important duties of a modern planning organization is to assist in the field of finance and taxation as applied to the highway transportation system. This problem is particularly acute in the State of New Jersey where public sentiment, in view of critical unemployment distress and in the belief that sufficient highways had already been constructed to adequately fulfill transportation needs, sanctioned the diversion of motor-vehicle revenues to other than highway uses. This diversion sentiment came largely from the cities and urban areas where a large portion of motor-vehicle revenues

were collected and where land-tax distress developed during the depression years. The people of the urban areas felt that motor-vehicle revenues collected from them were being used largely in rural areas and that they were deriving little benefit from such taxes. Therefore an equitable balance between highway expenditures in rural and urban areas is essential. It is interesting to note that in the three-year period 1940–1942 inclusive, 12 percent of the total motor-vehicle revenue in the sum of $615,000,000, was diverted from highway uses in the United States.

Another important highway planning function in the field of finance and taxation is the determination of an equitable distribution of motor-vehicle taxes over all classes of vehicles. In conjunction with this work, a study in cooperation with the Motor Vehicle Department might be made of maximum desirable vehicle size and weight with the objective of submitting model drafts of legislation for the consideration of the governor and the legislature.

It is considered that this is a most important task, for the role of the motor truck is so interwoven with the industrial and economic welfare of the state, not to mention the dependence of vast populations on the truck for the delivery of food, that any adverse unbalance in the economy of truck haulage would have an immediate and unfavorable effect on the people and business interests in the state.

It is essential, therefore, that a sound policy be formulated based on highway transportation needs as determined by traffic data and met by annual motor-vehicle revenues equitably adjusted in differential rate between all the various classes of vehicles and set at a level that will yield sufficient revenue to meet the needs of motor transportation adequately, but such rate structure must not exceed ability and willingness to pay. A policy contemplating motor-vehicle tax rates above ability to pay will result in diminishing returns, and more serious still, will have a tremendously adverse effect on the economy and social welfare of the state.

The American motorist and the trucking industry have shown an extraordinary willingness to pay motor-vehicle taxes but it cannot be expected that they will continue in this mood if the monies collected from them are diverted away from highway construction and maintenance or if a hit-or-miss or inequitable fiscal program is adopted. Highway planning provides the data and furnishes the key to the establishment of a sound fiscal policy based on the use factor.

GRADING OPERATIONS on first section of New Jersey's first parkway—to extend from Clifton in Bergen County to Cape May, a distance of 152 miles—are handled by dump trucks, bulldozers and sheepsfoot rollers. Small trees (upper view) within roadway limits are carefully removed for planting elsewhere. Fill is placed within right-of-way lines of section of parkway in Union County that parallels Rahway River (lower view).

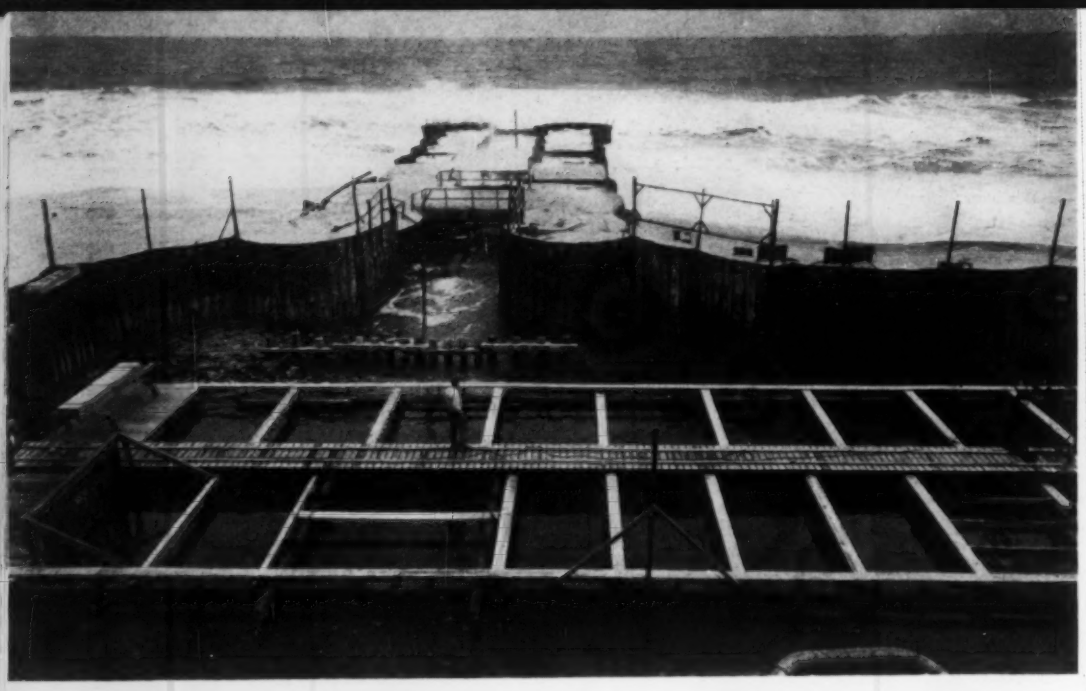
### Traffic-Volume Density Is Not Sole Criterion

In the establishment of a policy, care must be exercised in avoiding a blind acceptance of traffic-volume density as the sole criterion. There should be a recognition of the necessity to open up undeveloped areas in a state and to "subsidize" such areas with an adequate road system to stimulate development in order to effect an increase in land tax ratables on a state-wide basis, to spread out industry and population and to open up recreation areas.

Such a policy must be carefully balanced against the highway transportation needs of presently developed areas, otherwise industry, population and business will be sucked away from these areas, resulting in blighting them with consequent loss in land-tax ratables and a staggering loss in physical investment in schools, hospitals, playgrounds, parks, water supply, sewerage and street systems as well as other public utilities. The cost of government in these fully developed areas does not decline when there is a loss in land-tax ratables but rather increases. Consequently communities with declining ratables face almost certain bankruptcy.

A fertile field where economic analysis based on highway planning data will yield large dividends in state-wide prosperity is in developing an equitable fiscal policy establishing the ratio of available motor-vehicle funds that should be spent on the main state highway and urban system to that spent on the secondary or feeder system. It is clear that the

(*Continued on page 78*)



IN NATURAL CONDITIONS of seaside testing basin at Kure Beach, N.C., sea water attacks wood and metallic specimens. Originally located in channel through which sea water was pumped from ocean into bromine plant of Ethyl Dow Chemical Co., test facilities are now ideally located in basin formerly used as intake for pumps. Continuous supply of uncontaminated full-strength sea water is thus assured.

# Outdoor Laboratory Provides Information on Effects of Marine Corrosion

PRODUCERS OF COMPETITIVE products unite to fight a common enemy —corrosion—at the Kure Beach, N.C., sea water corrosion testing station where the effects of sea water, marine atmosphere and marine organisms on both metallic and organic surfaces are studied. In 1940 the Carnegie-Illinois Steel Corp., the Dow Chemical Co., magnesium division, and the American Rolling Mills Co. joined the International Nickel Co. in setting up test racks for subjecting specimens to atmospheric attack at a 1-acre outdoor laboratory at Kure Beach, near Wilmington, N.C. The expense of setting up and caring for what is believed to be the largest number of specimens on test at a single station anywhere in the world—about 15,000 at present—makes the investment in this lot amount to well over $300,000. Many new materials developed in this country and abroad during the war are included. In addition to the atmospheric tests more than 10,000 specimens have been tested in sea water in the past 12 years. The number now exposed is about 2,000.

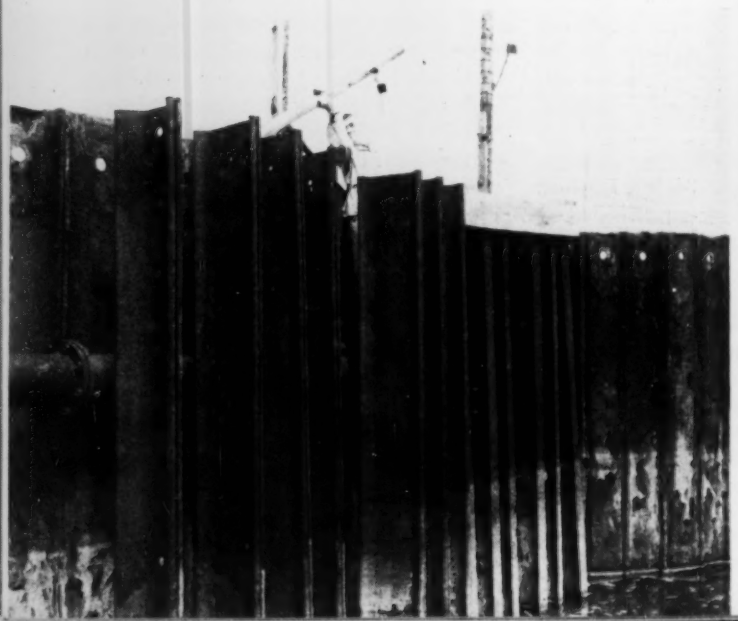
"PUTTING the ocean into a test tube," engineers at the Kure Beach, N.C., sea water corrosion testing station use shoreline conditions to study the effects of salt water, salt air and marine organisms upon many materials. Data collected in the industry-wide cooperative effort have benefited both private companies and government agencies.

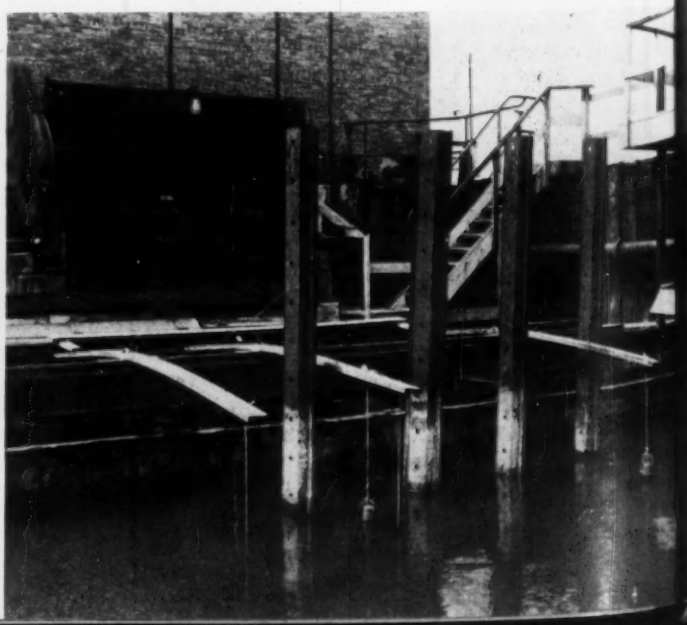
Established by the International Nickel Co. in 1935, the testing station originally was used for comparing the corrosion resistance of low alloy steels with carbon steel. Later, testing facilities were expanded to include the behavior of several kinds of protective coatings—both metallic and organic—the effects of marine growth on wood and metals and even the results of exposure of rope to sea spray and sea air.

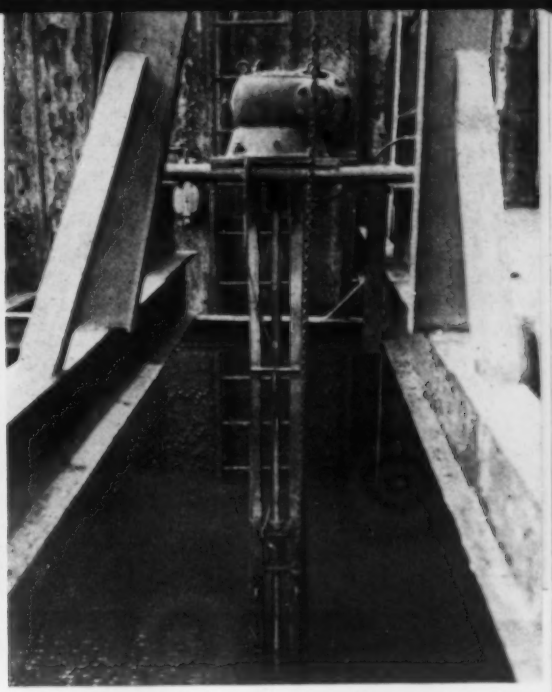
At Kure Beach effects of tides and other marine factors are captured exactly as they exist along the shoreline a few feet away, except that bulkheads break the force of the surf. Advantages provided at the test site include:

1. A continuous supply of full-

STEEL PILE TEST SPECIMENS (below, left), driven 20 ft into ocean bottom with 16 ft extending above mud line, yield information about distribution and extent of corrosion on plain and alloy steels. Periodic measurements of decrease in steel thickness determine progress of corrosion. Cathodic-protection tests (below, right) gage surface loss of metals in salt water. Metallic deposition is important factor in oceans because of sea water's electrolytic properties.







"WHIRLIGIG" SIMULATES erosive effects on condenser tubes, pump impellers, propellers and underwater parts of fast-moving ships. Specimens are fastened to large Monel disk (above, left) and whirled through sea water (above, right) at velocities up to about 30 fps.

strength sea water, uncontaminated by industrial wastes, oil films or other pollution.

2. A 45- to 85-deg F range of sea water temperature.

3. A long growing season for many marine organisms.

4. Protection against the physically destructive effects of storms and high waves.

5. A moderate fluctuation in water level permitting observation of water-line and intermittent immersion effects.

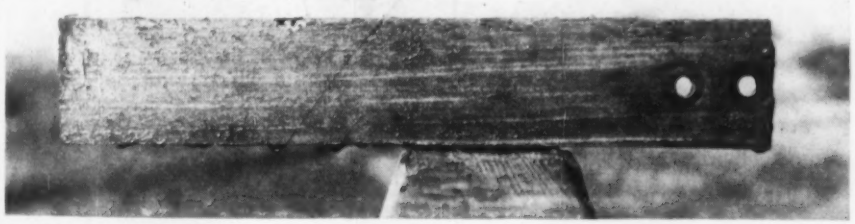
6. Protection against theft or tampering.

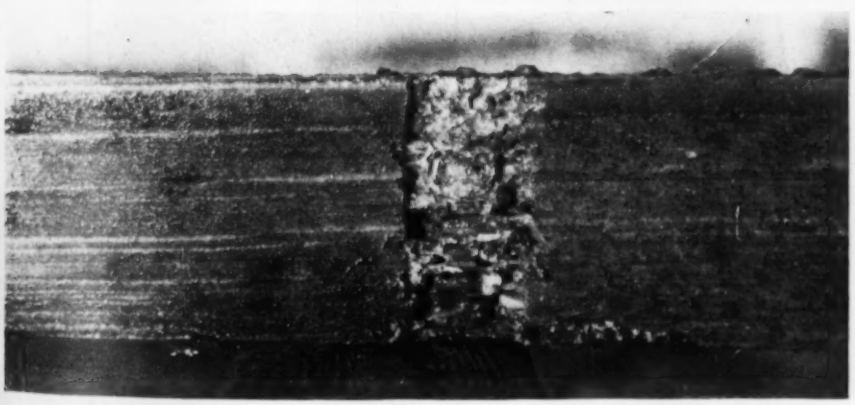
7. Personnel and mechanical equipment needed to erect and repair testing equipment and handle heavy racks of test specimens.

### Natural Conditions Are Essential

Comparative studies at the station have shown definitely that laboratory tests are inadequate for measuring the behavior of metals and alloys. Sea water is more than a mixture of chemicals; its corrosive reactions can be studied properly only by the exposure of specimens to attack under natural conditions. However, laboratory tests on small specimens in simple salt solutions, synthetic or reconstituted sea water or in salt-spray boxes provide a valuable supplement, particularly in preliminary investigation and in throwing light on the mechanism of sea water corrosion.

Study of the anti-fouling characteristics of metals, alloys, plastics, and protective coatings has been conducted with the active cooperation of Prof. William F. Clapp, of the William F. Clapp Laboratories, Boston, Mass. (see June 1947 CIVIL ENGINEERING, page 38). Specimens are exposed for from six months to several years on racks continuously immersed at a depth of from 3 to 4 ft. Twelve years has been the longest exposure to date. The number of specimens studied at any one time varies from about 1,000 to twice that number.

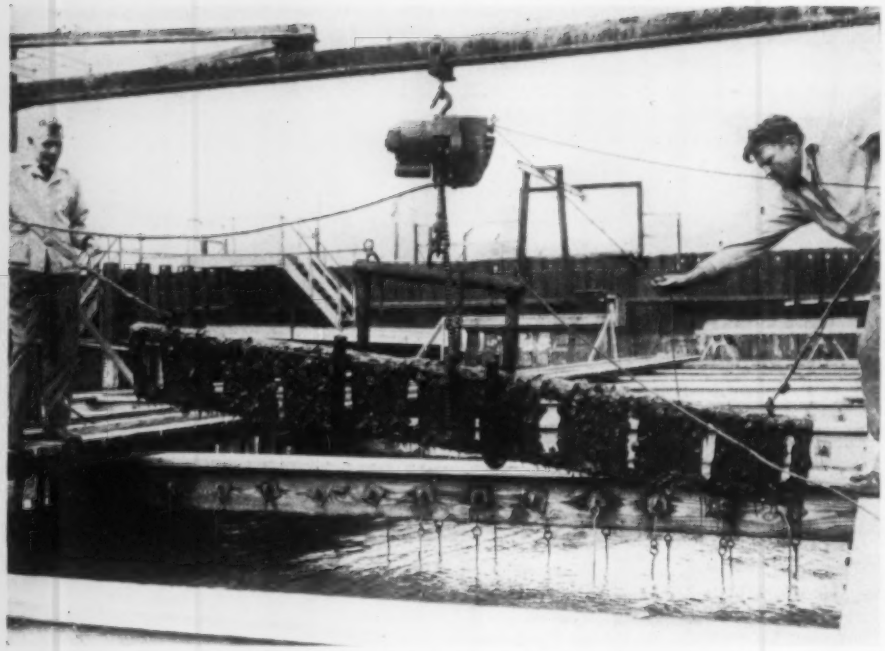




DAMAGE BY MARINE BORERS costs the United States an estimated $50,000,000 annually. Specimen (upper view) is removed for examination after exposure to teredo, one of most destructive types of marine borer, from which no untreated wood is entirely immune. Cut-away section (lower view) shows results of teredo attack.

### Motion of Parts Is Simulated

Specimens are fastened to corrosion resistive racks by means of Monel machine screws. Galvanic effects are prevented by the use of bakelite insulating tubes over the bolt shanks and insulating washers between the specimens and the racks and the Monel washers under the bolt heads. The success of this method has been demonstrated by the absence of galvanic effects on such materials as magnesium, aluminum and zinc-coated steel.



RACK FOR STUDY of anti-fouling characteristics of metals, alloys, plastics and protective coatings is removed from sea water for examination of specimens. Some racks and rods made of Monel, or of an alloy containing 70 percent copper and 30 percent nickel, are still serviceable after being in continuous use since 1935.

Service to be expected from condenser-tube alloys and other materials for use in sea water at high velocity is measured by the erosion testing apparatus, generally known as the Whirligig. A large Monel disk, a "K" Monel shaft to which it is fastened and motors and gears make up the device's essential parts. Specimens, insulated from the disk and from each other, are fastened to the disk and whirled through sea water at velocities up to about 30 fps.

Condenser tube alloys are tested in the form of short sections of tubes placed in the brackets that simulate sections of tube sheets. As the disk revolves, salt water rushes through these tubular test pieces under conditions of great turbulence so as to result in erosive effects as severe as any likely to be encountered in condensers.

The effect of impingement upon condenser-tube material also is measured by the aspirator-type jet impingement test apparatus. In it specimens are subjected to the action of submerged jets of salt water mixed with air bubbles.

Both of these testing machines produce in a couple of months as great an erosive effect as would ordinarily be encountered in as many years. The nature of the erosion and the appearance of the eroded tubes have proved almost exactly like those associated with long-time condenser service. Other possibilities of the high-velocity apparatus include investigations of pre-conditioning by exposure at relatively low velocity, seasonal and temperature effects on erosion, effects of velocity on the adherence and growth of fouling organisms, the performance of anti-fouling coatings and the adherence of protective coatings of various sorts.

### Steel Piling Tested

Tests on corrosion of plain and alloy steels above and below the water and in the region between high and low tide levels reproduce the identical form and almost the identical conditions to which the materials are subjected when in actual use. Periodic measurements of the decrease in the thickness of steels as they might be used for bulkheads or structural steel piling show the progress of corrosion. Specimens are in the form of interlocking piling sections or I-beams. Each one is driven 20 ft into the ocean bottom, with the remaining 16 ft of its length extending above the mud line through the water and into the air.

Atmospheric corrosion tests, of equal importance to the salt water studies, are made on a lot about 250 yd from the ocean shore. There effects of atmospheric corrosion are measured by visual observation and

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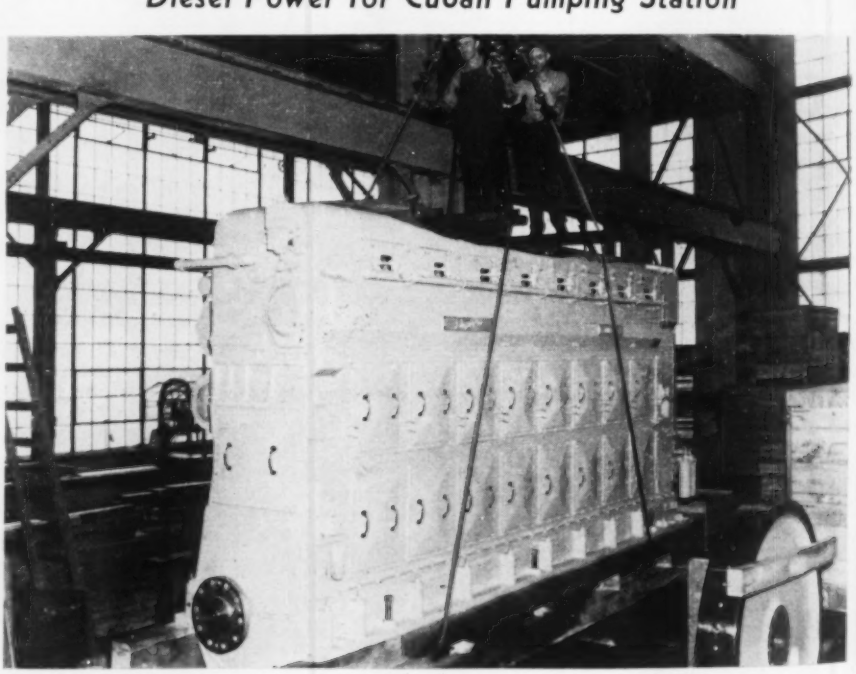
## *Diesel Power for Cuban Pumping Station*



HEADED FOR HAVANA, one of shipment of three large diesel engines boards flatcar for transportation to Casa Blanca Pumping Station in Cuban capital's sewage disposal system. Two units, 8-cylinder Model 80 generator sets, with 960 rated horsepower at 360 rpm; and third, 6-cylinder Model 80, with 720 rated horsepower at 360 rpm, are products of Springfield, Ohio, plant of Superior Engine Division, National Supply Co.

# Wind-Tunnel Tests Reveal Serious Inadequacy of Present Bridge Specifications

## Revisions Indicated for Safe Design

D. B. STEINMAN, M. ASCE
Consulting Engineer, New York, N. Y.

DEVELOPMENTS of recent years, including two major bridge catastrophies, have focused the attention of engineers on the subject of the wind forces acting on structures. This article deals with the *aerostatic* phase of the problem—the steady force of wind acting on a structure at rest—as distinguished from the *aerodynamic* problem of the modified, synchronized wind forces acting on an oscillating structure and tending to amplify the oscillations. The two aspects of the problem are related, so that basic data obtained from the same wind-tunnel tests are applicable to both phases.

AS AN ANTICIPATED extra dividend from a current systematic research program initiated primarily to supply needed data for the aerodynamic problem, valuable and revealing information has now become available on the simpler but equally important question of the static wind forces for which bridges should be designed. The information here presented is new knowledge; and in some respects it is startling. It reveals the serious inadequacy of the wind-load provisions in existing specifications, particularly in three significant respects:

1. The horizontal wind force on bridge sections may amount to three or four times the wind pressure prescribed in present standard specifications.

2. The vertical uplift due to wind, completely ignored in present standard specifications, may amount to three or more times the magnitude of the horizontal wind force.

3. The combined overturning moment due to wind may amount to *many* times (as high as 272 times) the overturning moment calculated in accordance with present standard specifications.

For half a century, following the Tay Bridge failure and the primitive wind pressure experiments for the design of the Forth Bridge, a provision for wind load has been included in bridge specifications. And for a half century, there has been no fundamental restudy or revision of the prescribed wind pressure.

For the past thirty years, a valuable experimental instrumentality for determining wind forces has been available. Aeronautic engineers have made intensive use of wind tunnels, but (with a few exceptions) bridge engineers have ignored the existence of this research facility to check their specifications.

### The Test Program

In 1941, in a published discussion, the writer called attention to the significant fact that the wind uplift on a bridge may amount to three or four times the horizontal force. In 1944, the Chester (continuous-truss) bridge over the Mississippi River was lifted and overturned by the wind.

In a discussion before the ASCE Metropolitan Section in January 1945 (published in CIVIL ENGINEERING in October 1945), the writer stated:

"For an accurate calculation of the overturning moments, the aerody-

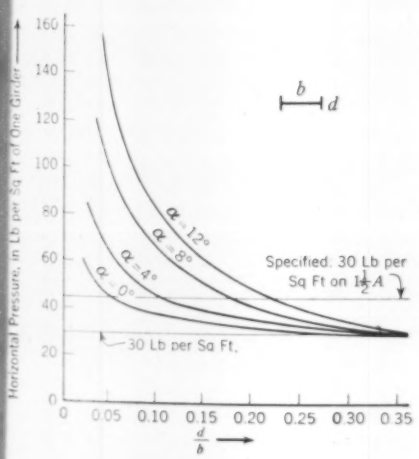



FIG. 1. HORIZONTAL wind force on H-girder sections, in pounds per square foot of elevation (single girder).

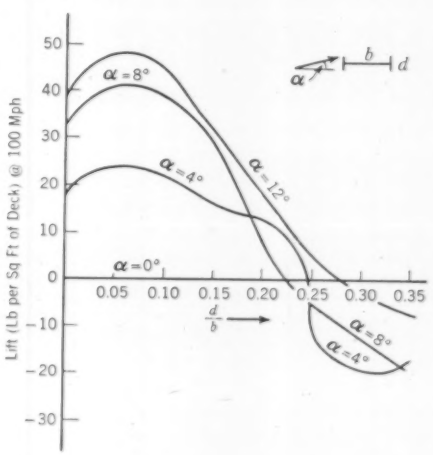



FIG. 2. VERTICAL lift force, in pounds per square foot at 100 mph, on H-girder sections for three angles of incidences.

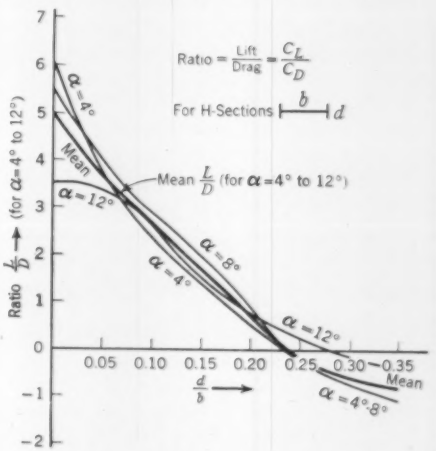



FIG. 3. RATIO of vertical lift to horizontal force on H-girder sections for varying section ratios and angles of attack.

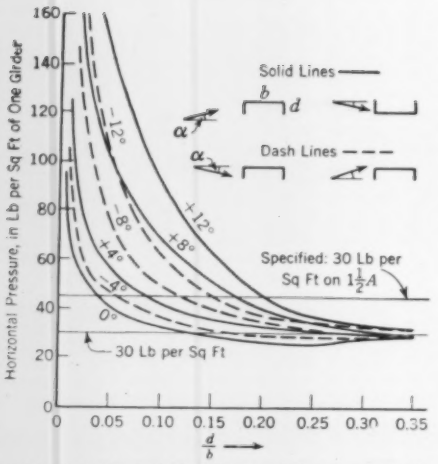



FIG. 4. HORIZONTAL wind force on deck girder sections, in pounds per square foot of elevation (single girder).

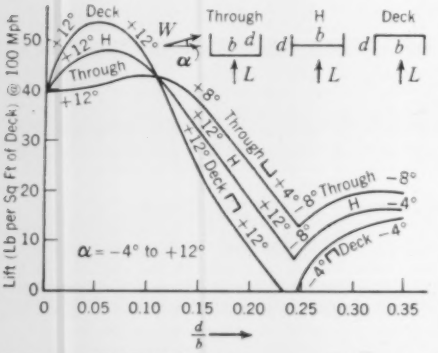



FIG. 5. VERTICAL lift force on girder sections, in pounds per square foot at 100 mph.

namic constants of the section are required. These can be easily and quickly obtained in a simple wind-tunnel test on a section model, to determine the coefficients of drag, lift, and torque. A systematic series of static wind-tunnel graphs covering the range of typical bridge sections is urgently needed by the profession. From such series, the aerodynamic characteristics of any section could be reliably estimated without requiring wind-tunnel tests on each new design. For the past several years, I have been pleading for such systematic information."

In response to that appeal, Prof. F. J. Maher, of Virginia Polytechnic Institute, generously volunteered to undertake the series of tests which the writer had outlined, using for that purpose the available wind tunnel of the Institute. This test program has since grown in scope, with the welcome help of a grant-in-aid from the Research Corporation. Valuable information has already been secured toward the complete scientific solution of the aerodynamic problem, but at the same time the tests yield equally needed information on the more common problem of static wind forces. It is this more elementary but equally significant aspect of the test results that is reported here, leaving the aerodynamic discoveries to a subsequent article.

The numerical data and the graphs presented here have been computed and plotted by the writer from Professor Maher's wind-tunnel test curves. For convenience in practical application, the wind-tunnel coefficients (of lift and drag) have been translated into corresponding pressures in the more familiar terms of pounds per square foot at a wind velocity of 100 mph.

### H-Sections

The simplest case is a half-through plate girder section, termed an H-section. The aerodynamic and aerostatic characteristics are determined by the section ratio $d/b$, where $b$ is the width of the section and $d$ is the girder depth. Figure 1 records the horizontal pressure of wind on such sections, varying with the depth ratio $d/b$ and with the angle of incidence $\alpha$. Even with horizontal wind, the pressures range from 30 to 50 or 60 lb per sq ft (of one girder). With wind inclined (either upward or downward) 4, 8, or 12 deg, more of the rear girder becomes directly exposed and the maximum *horizontal* resultants increase to 80, 120, and 150 lb per sq ft, respectively. For comparison, the usually specified wind load is only 30 lb per sq ft on $1^1/_2$ times the area of one girder, corresponding to an ordinate of 45 in the accompanying diagram, Fig 1.

Figure 2 shows the *vertical* lift force on the same H-sections, for angles of incidence of 4, 8, and 12 deg respectively. This force, completely neglected in existing standard specifications, may amount to more than 30 or 40 lb per sq ft of deck; and this is usually a much larger area than that on which the horizontal force is figured.

In Fig. 3 is plotted the ratio of the vertical lift force to the horizontal force (or "drag") for the varying section ratios and angles of attack. The curves for the different angles of incidence are not far apart, so that they may be represented approximately by a single curve for the mean ratio. For the shallower sections, the ratio of lift to drag may attain values up to 5 or 6, even at low angles of inclination of the wind. In other words, the horizontal force may amount to 3 times that specified, and the vertical force (missing from the specifications) may amount to 5 or 6 times the horizontal force.

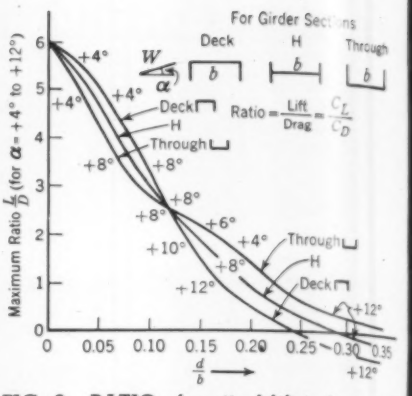



FIG. 6. RATIO of vertical lift to horizontal force on girder sections.

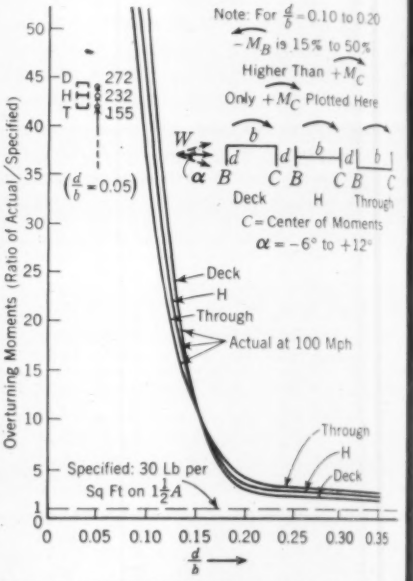

Overturning Moments (Ratio of Actual/Specified)
Note: For d/b = 0.10 to 0.20
−M_B is 15% to 50% Higher Than +M_C
Only +M_C Plotted Here
C = Center of Moments
α = −6° to +12°
Deck
H
Through
Actual at 100 Mph
Specified: 30 Lb per Sq Ft on 1½A
d/b

FIG. 7. OVERTURNING moments on girder sections—ratio of actual to specified.

### Plate Girder Sections

For deck and through sections of the plate-girder type, Fig. 4 shows the horizontal pressures at various angles of incidence, running up to values as high as 160 lb per sq ft of one girder (compared with $1^1/_2$ times 30, specified). Even at zero inclination of the wind, the horizontal force on shallow sections may be as high as 60 to 80 lb per sq ft.

Figure 5 is a composite graph giving the *vertical* wind force on the three representative types of plate-girder bridge sections: through, H, and deck, at 4- to 12-deg angle of incidence. The lift forces attainable in the three respective forms of cross section are as high as 42, 48, and 54 lb per sq ft of *deck*.

In Fig. 6, the maximum *ratios* of vertical lift to horizontal force are plotted for the three forms of plate-girder bridge sections. For the shallower sections, at 4-deg angle of attack, this ratio runs up to a limiting

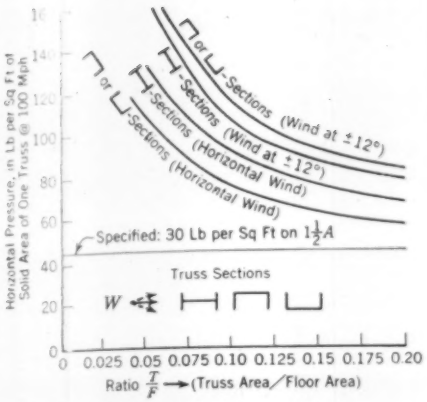

Horizontal Pressure, in Lb per Sq Ft of Solid Area of One Truss @ 100 Mph
H-Sections (Wind at ±12°)
H-Sections (Horizontal Wind)
Specified: 30 Lb per Sq Ft on 1½A
Truss Sections
W
Ratio T/F → (Truss Area/Floor Area)

FIG. 8. HORIZONTAL wind force on truss sections.

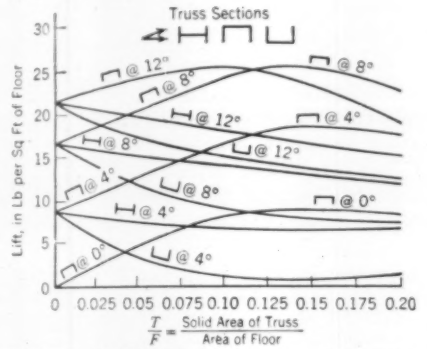



FIG. 9. VERTICAL lift force on truss sections, in pounds per square foot of floor.

value of 6 for all three types. The component neglected in standard specifications is several times as large as the component included.

Moreover, on account of the greater leverage, the neglected component (vertical lift) is more effective than the specified component (horizontal drag) in producing overturning moment. This is strikingly revealed in Fig. 7, in which the actual overturning moments (calculated from the test results) are compared with the specified values. Even for the deepest sections, the ratios of actual to specified overturning moments are from 2 to 3; for intermediate section depths, the calculated ratios range from 5 to 10; and for shallow sections, the overturning ratio shoots up to calculated values of 155, 232, and 272 for through, H, and deck sections, respectively. A practical minimum depth ratio of $d/b = 0.05$ was assumed; for the theoretical limiting case of $d/b = 0$, the overturning ratio would be infinity.

The overturning moments compared in Fig. 7 are calculated about the (leeward) heel of the cross-section. It is perhaps startling to note that the negative overturning moments (into the wind), calculated about the windward toe of the cross-section, may be even greater than the positive overturning moments. For depth ratios of $d/b = 0.10$ to 0.20, the backward overturning moments may be 15 to 50 percent higher than the forward overturning moments. This result, surprising at first glance, is explained by the fact that, for these sections, the dominant vertical resultant acts upward on the leeward side of the center line.

### Truss Sections

In Figs. 8 to 11, the wind forces on *truss sections* are recorded. Instead of the depth ratio $d/b$, a new parameter is here introduced, namely $T/F$, where $T$ is the solid area (in elevation) of the truss, and $F$ is the area (in plan) of the floor or deck. (As applied to a solid girder bridge, $T/F$ would be identical with $d/b$.)

The horizontal wind force on truss sections is plotted in Fig. 8. In practically all cases, this horizontal force exceeds 60 lb per sq ft of solid area of one truss (compared with 30 lb per sq ft on $1^1/_2$ times the area, specified). In horizontal wind, the horizontal pressure may exceed 100 lb per sq ft on deck or through sections, and 120 lb per sq ft on H-sections. In inclined wind (± 12 deg), the horizontal pressure may exceed 160 lb per sq ft of truss, or over $3^1/_2$ times the horizontal force assumed in present specifications.

Figure 9 shows the vertical lift forces on truss sections, for through, H, and deck types, at 0, 4, 8, and 12-deg incidence. The deck sections experience the highest lift forces, the through sections experience the lowest lift, and the H-sections are intermediate. At 0, 4, and 8-deg (upward) incidence, the respective lift forces are as high as 9, 19, and 25 lb per sq ft of deck.

The ratio of vertical to horizontal forces (lift to drag), recorded in Fig. 10 for truss sections, may amount to 2.5 for H and through sections, and to 3.5 for deck sections.

The ratio of actual to specified overturning moments for truss sections is plotted in Fig. 11. A composite parameter is used ($d/b \times T/F$), in order to take into account the leverage ratio as well as the area ratio. Even for the deepest sections, the calculated overturning moment is 2.5 to 4 times the specified value; for intermediate sections, the ratio is from 5 to 15; and for the shallower sections, ratios as high as 35 to 40 are revealed. These findings emphasize the inadequacy or incompleteness of the present standard specifications. They also emphasize the danger of omitting hold-down anchorages on bridges unless ample safety against overturning is fully investigated and assured.

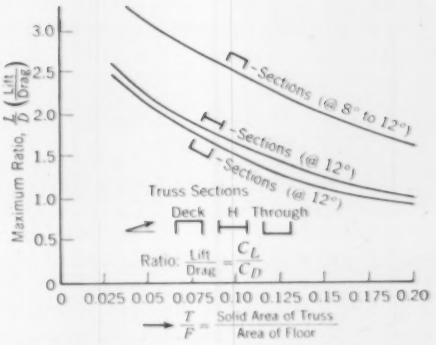

Maximum Ratio, ½ (Lift/Drag)
T-Sections (@ 8° to 12°)
H-Sections (@ 12°)
T-Sections (@ 12°)
Truss Sections
Deck H Through
Ratio: Lift/Drag = C_L/C_D
T/F = Solid Area of Truss / Area of Floor

FIG. 10. RATIO of vertical lift to horizontal force on truss sections.

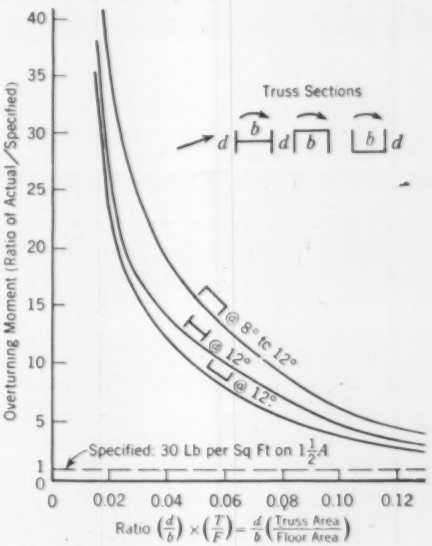

Overturning Moment (Ratio of Actual/Specified)
Truss Sections
@ 8° to 12°
@ 12°
@ 12°
Specified: 30 Lb per Sq Ft on 1½A
Ratio (d/b) × (T/F) = d/b (Truss Area / Floor Area)

FIG. 11. OVERTURNING moments on truss sections—ratio of actual to specified.

### Effect of Open Floor

Figure 12 presents a revealing study of the effect of open-grid floors on the total horizontal force produced by *horizontal* wind. A relationship is revealed that will be surprising to most readers, namely, that the total horizontal wind force on a bridge actually *increases* with the percentage of opening in the floor area. The horizontal resultant on H-sections (in pounds per square foot of one girder) increases from 30 lb for the bridge with solid floor, to 40 or 45 lb for the bridge with 33-percent openings in the floor, 55 or 60 lb for the bridge with 66-percent openings in the floor, and 65 to 75 lb for the bridge with floor removed. With the floor removed, the horizontal resultant is made up of the positive pressure on the windward face of each girder plus the negative pressure on the leeward face of each girder. Apparently, with the floor restored, the shielding or flow deflection by the deck has a

streamlining effect, restricting interaction and fluctuation of flow across the median horizontal line, with a consequent narrower wake and reduced drag.

### Wind Inclination

The data above presented refer to various angles of incidence from zero to ±12 deg. Necessary information on the range of wind inclination to assume for design, or as a basis for design specifications, is lacking. Existence of inclined wind flow, influenced by terrain or thermal conditions, is generally accepted. Recent measurements at two long-span bridges indicate upward wind inclination ranging from +6 to +12 deg, and from zero to +20 deg, respectively, with a mean value exceeding +8 deg. Those reported findings, however, are not conclusive, since the measuring head of the instrument, although mounted at some height above the deck, was not located beyond the range of deflected airflow over the bridge cross-section. Additional observational data, free from the suggested source of error, are needed. Until more conclusive information is available, it would appear hazardous to assume that the wind is always horizontal; and for safe design, an assumed potential range of ±12 deg of wind inclination is suggested.

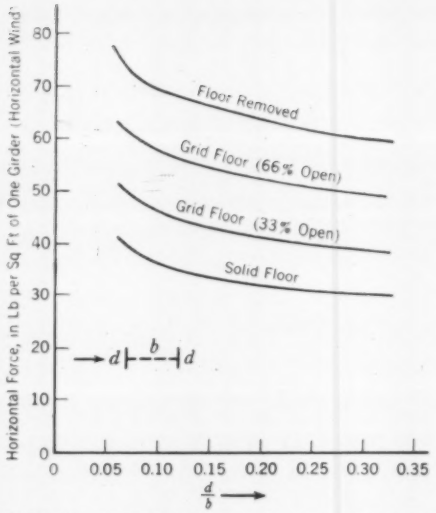



FIG. 12. EFFECT of open floors on horizontal wind force.

### Conclusions

The revision of existing standard specifications is a conference procedure. An individual offering merely invites sales resistance. In this article the writer has endeavored to indicate:

1. The directions in which the existing wind clauses in bridge specifications need to be restudied and revised.
2. The demonstrated hazard of building bridges without hold-down anchorages unless safety against overturning by wind is amply assured.
3. The neglected potential usefulness of the wind tunnel to the structural engineer in supplying basic aerostatic information needed for safe design against wind.
4. The necessity for conclusive information on the range of wind inclination to assume for safe design—information now lacking.
5. The importance of a better understanding of basic aerodynamic and aerostatic principles by the structural engineer, and of a better cooperative interest in structural problems by the aeronautic engineer; or, in more general terms, the importance, in engineering education and practice, of greater breadth of training and of directed interest.

## Crane Lifts 25-Tons at 150-Ft Reach

WORLD'S LONGEST MOBILE CRANE, specially designed by Le Tourneau for unloading steel from river barges at Vicksburg, Miss., has 25-ton capacity at maximum reach of 150 ft. Distance from Tournapull operator's cab to free end of boom (300 ft) is too great for accurate control, so electrical push button is provided for lift-control operator located near end of boom. Fulcrum of crane is axle supported by dual 30×33-in. tires—about 8 ft tall. Dubbed "Tournastretch" for want of better name, crane and prime mover weighing 210,000 lb may be used for erecting steel in building construction and on other jobs where extremely high lifts and heavy loads are involved.

# Engineers, Businessmen Cooperate on Solution of Urban Traffic Problems

"BEFORE ENGINEERING TECHNIQUES can come to the relief of cities to aid them in their traffic dilemmas and the redesign of the historic but outgrown city pattern, there must first be available the necessary authority, including legislation and continuing financial support."

### Public Backing Sought

This statement was made by Thomas H. MacDonald, Hon. M. ASCE, Commissioner of the Public Roads Administration, before the Businessmen's Conference on Urban Problems which the Chamber of Commerce of the United States conducted in Washington, D.C., September 11 and 12 It virtually was the keynote of the conference, which was called by the U.S. Chamber for the purpose of arousing public interest in postwar urban traffic problems. The Chamber's announced view in scheduling the sessions was "that the business element of each community can perform a valuable service by participating in the consideration of various proposals, by helping to mobilize public opinion behind accepted solutions, and by helping to translate plans into definite accomplishments."

Four panels were conducted during the two-day gathering, with ASCE members playing prominent roles (see CIVIL ENGINEERING for August, page 60). The panels were on "Relations of City Planning to Community Development," "Traffic Congestion," "Off-Street Parking," and "Rebuilding Blighted Areas."

Mr. MacDonald spoke on the first-named panel, reading a paper prepared jointly by him and H. S. Fairbank, deputy commissioner, Public Roads Administration.

"The Federal-Aid Highway Act of 1944 holds greater promise of aid to the cities than any other recent national legislation because it supplies the two essentials of a definite long-term administrative pattern and financial assistance reasonably comparable to the work that can be actually accomplished under existing conditions," he stated.

Emphasizing that the new act's principal characteristic is its aim to achieve an integrated development of the major classes of streets and highways to effect an ultimate national traffic network, Mr. MacDonald pointed out that this constitutes an abandonment of the limited objectives of the Federal Highway Act of 1921 and all state legislation of the earlier period. Earlier legislation, he said, sought to designate limited systems of main interurban, rural highways and the allocation of earmarked funds for use in the improvement of the limited systems.

"The consequences of this tendency to date," Mr. MacDonald asserted, "are reflected in the disposition of road-user revenues in 1946. The record for this latest year shows 70.7 percent was allotted for expenditures by the state highway departments; 24.9 percent was allotted to counties and lesser subdivisions, and 4.4 percent was directly allocated for expenditure by municipalities.

### Funds for Urban Areas

"Into this situation, the Federal-Aid Highway Act of 1944 comes as a new dispensation, radiant with promise, for the cities especially. Of the $500,000,000 total federal appropriation authorized for each of the first three postwar years, $125,000,000 is earmarked exclusively for expenditure in 'urban areas,' defined as areas including and adjacent to municipalities of 5,000 population or more."

Pointing out that other benefits will accrue to urban areas under the new act, Mr. MacDonald stressed the fact that the $125,000,000 specifically earmarked for urban centers represents an expenditure per capita of the included cities of $1.80, on the basis of the 1940 population. This, he said, is approximately 50 percent of the amount the cities are spending of their own funds for all road and street purposes.

"We would do scant justice to the broad purposes of the Federal-

(*Continued on page 70*)

## *Vertical Expansion Features Los Angeles Traffic Interchange*

FOUR-LEVEL GRADE SEPARATION structure in the heart of Los Angeles business section solves difficult traffic interchange problem on two major freeways, Hollywood Parkway (top level) and Harbor Parkway (two levels below). Vertical rather than lateral expansion is found essential in plans prepared by F. W. Panhorst, M. ASCE, bridge engineer for the California Division of Highways to handle great volume of traffic in narrow limitations of site. All freeway traffic enters interchange and departs via right-hand lanes. C. H. Purcell, Hon. M. ASCE, state director of public works, recently announced award of contract for project to James I. Barnes Construction Co., Santa Monica, at $1,296,595.

LACK OF WEATHER SERVICE to operators of motor vehicles such as that offered aircraft operators is cause of major economic losses on nation's highways. Pictured here are vehicles snowbound in Ste. Rose, Canada, early this year. (Associated Press Photo)

# Meteorological Engineering Aids Highway Transportation

C. C. BATES and A. H. GLENN

Respectively U.S. Navy Hydrographic Office, Washington, D.C.; and Air Weather Service, U.S. Army Air Forces, Washington, D.C.

IN THE FIELD OF TRANSPORTATION, meteorological engineering has been extensively utilized only by the commercial airlines. Because of strong legislative pressure, more than a third of the U.S. Weather Bureau's efforts are directed toward supplying the operators of approximately 800 commercial and 84,000 private aircraft with current information on weather conditions along the various air routes. As recently as 1945, there was no weather service offered to the operators of motor vehicles that was in any way comparable to the one offered aircraft operators, although approximately 850 million dollars was paid in taxes for the privilege of operating more than 5 million trucks and buses and 25 million automobiles. Adverse weather and resulting poor road conditions caused major economic losses on the nation's highways. Methods of reducing this weather hazard by utilization of meteorological engineering are discussed here.

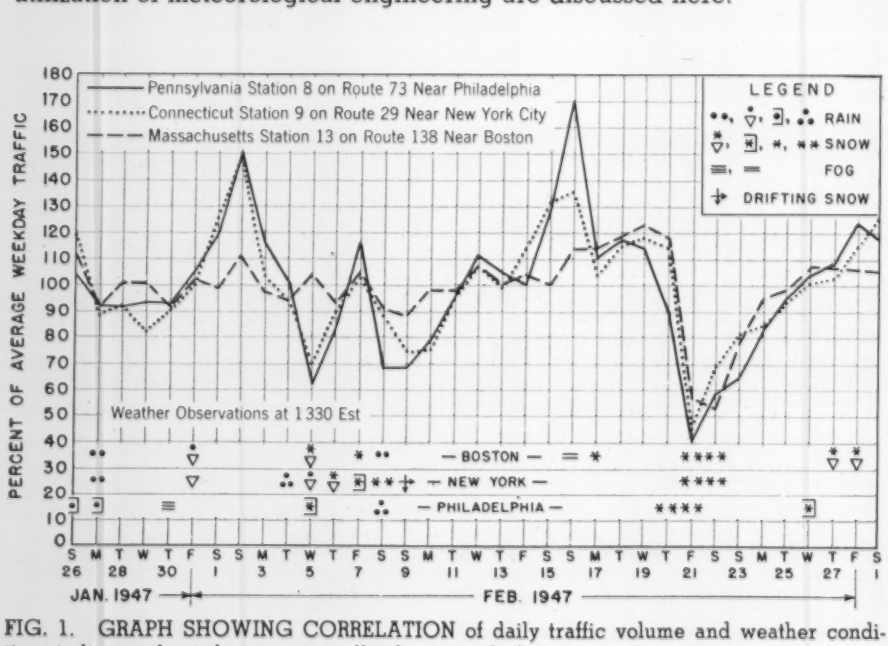

Pennsylvania Station 8 on Route 73 Near Philadelphia
Connecticut Station 9 on Route 29 Near New York City
Massachusetts Station 13 on Route 138 Near Boston
LEGEND
RAIN
SNOW
FOG
DRIFTING SNOW
PERCENT OF AVERAGE WEEKDAY TRAFFIC
Weather Observations at 1330 Est
— BOSTON —
— NEW YORK —
— PHILADELPHIA —
S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S
26 28 30 1 3 5 7 9 11 13 15 17 19 21 23 25 27 1
JAN. 1947
FEB. 1947

FIG. 1. GRAPH SHOWING CORRELATION of daily traffic volume and weather conditions indicates sharp decrease in traffic during and after severe snowstorms.

MOST MOTORISTS have first-hand knowledge of the effect of bad weather and resulting poor road conditions upon driving. Although heavily traveled highways are rarely blocked to the extent shown in the photograph above, the decrease in road trafficability as a result of snow and ice conditions causes tremendous financial loss.

Traffic data furnished by the Public Roads Administration and plotted in Fig. 1 indicate quantitatively the rather obvious fact that traffic volume decreases sharply during and after severe snowstorms such as those that swept northward along the Eastern seaboard during February 1947. Adverse weather conditions are also an important factor in many highway accidents. Even for a highway as carefully designed and maintained as the Pennsylvania Turnpike, records,[1] summarized in Fig. 2, show that nearly half the accidents occur when the surface is covered with ice or snow or is wet and that one-third of the accidents occur in fog, rain or snow. It is obvious that in the five-year period observed, poor road conditions

did not occur half the time or poor weather conditions a third of the time. Thus it must be concluded that there is a much higher frequency of accidents under poor road and weather conditions.

Between the years 1941–1945, 17 to 25 percent of the fatal accidents (Fig. 3) occurred when the road surface was wet, muddy or covered with snow or ice.[2] This percentage approximately equals that for accidents, in which drunkenness was a contributing factor. During the same period, only 14 percent of the accidents in commercial airline operation and only 5 percent of the accidents in private flying were assigned to weather causes.

Highway losses in lives and money resulting from weather conditions, when compared to airway losses from weather, suggest that methods of further reducing the highway weather hazard might well be considered. Two methods immediately suggest themselves. The first is a comprehensive consideration of weather factors in highway design and maintenance; the second, the distribution of up-to-the-minute information concerning weather and road conditions to the operators of motor vehicles.

### Highway Design and Maintenance

In the design and planning stages of maintenance, there have been very few cooperative studies made by highway and meteorological engineers in an attempt to reduce weather hazards. This lack of cooperation cannot be ascribed to a paucity of weather factors. Many elements in design and maintenance are controlled or affected by weather conditions. For example, the type and size of culverts required depend upon rainfall and snow-melt over drainage basins. The required size of expansion joints in bridges or in concrete slabs is a function of the range in air and soil temperatures. Air temperatures and the duration and intensity of sunlight are factors in the softening and deterioration of bituminous structures. The amount and severity of frost-heave is a function of temperature, and settling of fills is partly dependent upon precipitation and temperature.

Enlargement of hairline cracks on concrete slabs, a major cause of highway deterioration, results from repeated freezing and thawing of the water that drains into minute crevices. Precipitation, snow-melt and soil temperatures are the important meteorological factors in flood conditions that cause extensive damage to highway systems. Construction methods, particularly laying and curing of concrete, depend upon temperature and precipitation. Likewise, necessary expenditures for snow and ice control are governed by such factors as snowfall, wind, temperature and insolation.

It is thus apparent that without evaluation of the weather element, proper highway design is impossible. Recognizing this fact, highway engineers years ago attacked the problem of evaluating the weather element from an empirical standpoint. Such studies resulted in the development of formulas for determining runoff through culverts, methods of minimizing frost damage, design of effective expansion joints, and other advances in the highway engineering field.

Expensive as it was, the empirical approach to the solution of weather problems was necessary, because highway engineering was in its maturity before meteorological engineering methods, which permit a direct approach to such problems, were developed. Fortunately a direct approach to weather problems is now possible through joint research by meteorological and highway engineers. A detailed discussion of the meteorological engineering methods applicable in highway design and maintenance is beyond the scope of this article. However, one of the highway engineer's weather problems, snow removal, will be considered in detail.

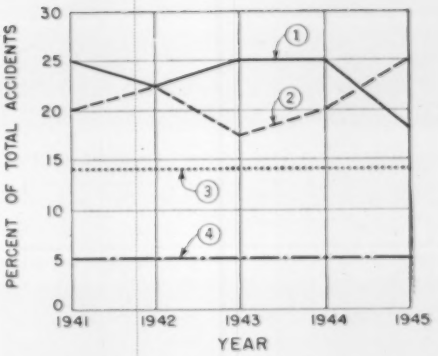



FIG. 3. STUDY OF WEATHER factor shows that percentages of fatal automobile accidents when weather is cloudy, rainy, snowy or foggy (Curve 1) and when road is wet, snowy, icy or muddy (Curve 2) are higher than percentage of airline accidents (Curve 3) and private flying accidents (Curve 4) caused by weather. Latter two curves are based on five-year averages.

### Snow Removal Difficult and Expensive

Snow removal is difficult and expensive—so expensive, in fact, that careful investigation of possible reductions in winter maintenance cost by highway and meteorological engineers is warranted. In the reduction of these costs, there are several possibilities. The most obvious is the selection of a right-of-way that will avoid the areas of maximum snowfall when new road locations are under consideration. In mountainous regions, the windward slopes subject to orographic snowfall should be avoided as much as possible, and the right-of-way restricted to those zones of the leeward slopes with minimum snowfall.

Along the leeward lake shores, rights-of-way should be selected as far as possible in the zone of minimum frequency of instability snow showers. For example, in Chautauqua County, New York, which borders Lake Erie, there is a "snow belt" approximately 10 miles wide and 40 miles long that is parallel to, and about 5 miles inland from, the lake.[3] The snow showers in this belt, caused by the upward motion of unstable continental polar air crossing a thousand-foot range of hills, result in a total snowfall about three times as great as in adjacent areas where the average is about 90 in. yearly. Wiggin observed[4] that in a 50-mile stretch of road, 10 miles may have twice as much snowfall as the remaining 40 miles because of variations in elevation, air currents and temperature. By investigation of the snowfall distribution, the meteorological engineer

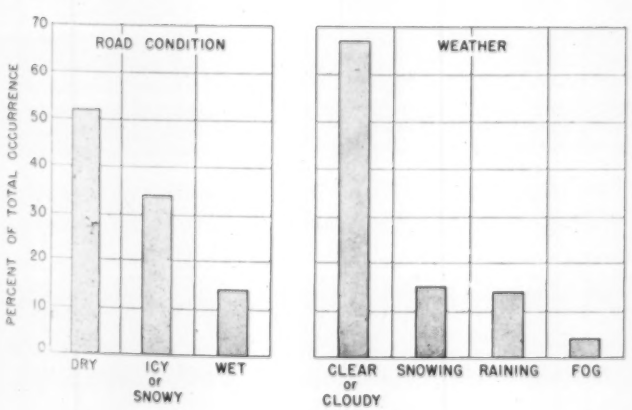



FIG. 2. RECORDS SHOW that nearly half of accidents on Pennsylvania Turnpike occur when surface is icy, snowy or wet, and that third of accidents occur in fog, rain or snow. Number of accidents recorded from October 1, 1940, to June 30, 1946, totals 1,790.

**WINTER MAINTENANCE COSTS** may be reduced by selection of proper rights-of-way to avoid areas of maximum snowfall. Here, Caterpillar V-type snow plow clears township road near Mankato, Minn.

can determine which of several possible rights-of-way will require minimum snow removal.

Another possibility in reducing winter maintenance costs is the use of fences and snow hedges or the selection of cut-and-fill cross sections with eddy characteristics which keep snow drifting to a minimum or cause drifting away from the highways. Snow fences are commonly used in areas subject to drifting to remove the blown snow from the air before it reaches the highway. Once the surface wind directions and speeds causing greatest drifting are known, the optimum location and orientation of the fences can be determined. The contribution of the meteorological engineer in this case is in fence placement. This is not a simple matter. Fitch[3] notes that a number of possibilities in the placement of snow fences have been tried in New York State, and that proper erection of snow fences requires a great deal of time and study. In the case of snow hedges, proper location and orientation is particularly important since transplanting a large number of trees is not as simple as moving a snow fence.

Finney[5] investigated the drifting characteristics of various models of of road cuts and fills, using a wind tunnel with flaked mica or balsam dust to simulate snow. His results indicated the proper design for minimizing drift, but again the unknown quantity as far as the highway engineer is concerned is the wind characteristics at the location of the cut or fill. In most cases, the cost of earthwork probably far exceeds the cost of snow removal, so that as a rule it is a dominating consideration. In the case of passes on U.S. Highway 40 over the Colorado Rockies, however, where the yearly cost of snow removal aggregated $53,600, it was found economical to regrade the slopes of the cuts and fills to minimize drift-producing eddy currents.

### Use of Solar Radiation in Snow Removal

A meteorological element which has not been fully utilized by the highway engineer in snow and ice removal is solar radiation.[7] Where highways are not shaded, melting will depend upon the rate of absorption of radiant energy, thickness and amount of cloud cover, and angle of elevation of the sun. If the meteorological engineer finds the two latter conditions favorable for melting, it may be economical to increase the absorption properties of the highway surface by the use of a dark-colored surface material or by sanding with a black, granular material (coal dust, cinder dust or possibly even a black-dyed sand). It is a common observation that secondary roads with black surfaces clear sooner than concrete roads. A noteworthy case is the Pennsylvania Turnpike, a concrete superhighway built for high-speed traffic, which unfortunately retains treacherous patches of packed snow and ice after secondary blacktop roads nearby are clear.

Most cities and states prepare elaborate plans for rapid mobilization of snow removal equipment and personnel in the event of a storm. Experience has shown that the plans are frequently rendered impractical because of variations in the snowfall pattern and the type of snow. As a result, several different mobilization plans are sometimes made. Cincinnati, for example, has two plans[6]—one for light or average snow, and the other for heavy snow. In the preparation of these mobilization plans, particularly those for statewide snow removal, the meteorological engineer can provide valuable assistance to the highway engineer by analyzing and typing snowfall synoptic situations and determining type, depth and distribution of snow for each. A snow-removal plan can then be drawn up for each of the frequently occurring types, and the proper plan for each storm selected on the basis of short-

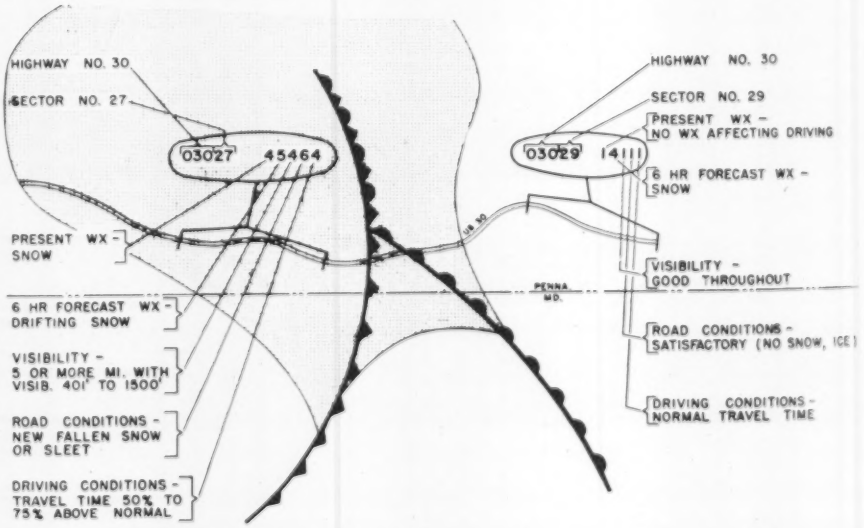

HIGHWAY NO. 30
SECTOR NO. 27
03027 45464
PRESENT WX - SNOW
6 HR FORECAST WX - DRIFTING SNOW
VISIBILITY - 5 OR MORE MI. WITH VISIB. 401' TO 1500'
ROAD CONDITIONS - NEW FALLEN SNOW OR SLEET
DRIVING CONDITIONS - TRAVEL TIME 50% TO 75% ABOVE NORMAL
HIGHWAY NO. 30
SECTOR NO. 29
PRESENT WX - NO WX AFFECTING DRIVING
03029 14111
6 HR FORECAST WX - SNOW
VISIBILITY - GOOD THROUGHOUT
ROAD CONDITIONS - SATISFACTORY (NO SNOW, ICE)
DRIVING CONDITIONS - NORMAL TRAVEL TIME
PENNA.
MD.

FIG. 4. SIMPLE "ROAD CODE" may be used to report weather conditions to highway users. Code numbers for fictitious snowstorm situation over Pennsylvania are explained on chart. Table I gives breakdown of elements referred to by numbers in code.

range weather forecasts in order to minimize the possibility of having expensive snow-removal equipment and personnel in the wrong place when the storm occurs. For example the states southeast of the Great Lakes are subject to snowfall from instability showers following polar outbreaks and also from cyclones approaching from the south and west. The distribution and type of snowfall differ in both cases so that each type of storm requires a different plan.

### Distribution of Weather and Road Information

Added efficiency in highway transportation may be expected if drivers are provided with applicable and up-to-the-minute information regarding weather and resulting road conditions. If such information is available, the driver can decide whether a trip should be postponed, rerouted or continued, perhaps with certain safety precautions. The decision of the private motorist will be based upon the urgency of the trip, availability of other types of transportation and the amount of pleasure involved; while the driver of a commercial carrier will have to consider the necessity of maintaining schedules and possible monetary loss caused by late arrival or the deterioration of perishable cargo. Dispatchers are interested in holding, rerouting or "hiballing" trucks when necessary to avoid traffic delays caused directly or indirectly by the weather.

Motor clubs and state highway departments have already recognized the short-range weather factor in highway transportation. A study of their efforts indicates that at present an appreciable amount of money is being expended to provide a weather service for highway transportation. This service when compared with that provided to the airlines is extremely primitive. The more apparent weaknesses are:

1. Lack of a national agency formally responsible for collecting, processing and disseminating on a fixed schedule standardized reports of road and weather conditions specifically designed for highway use.
2. Road information, generally gathered on a statewide scale only once a day, is not available until 8:30 a.m. or later, and changes in conditions are often unreported.
3. Weather and road information, now disseminated to the public via commercial radio, newspapers and telephone, is comparatively ancient when compared to the freshness of the information available to airplane pilots. For example, newspaper information is at least 4 to 8 hours old, while CAA information is only from 30 to 60 minutes old.
4. So little is known of the effects of ice, snow, fog, rain, temperature, etc., upon traffic volume, speed, and purpose and length of trip, that weather forecasters are not able to prepare specific forecasts for the motorist. Forecasting of road conditions is still in its infancy.

Probably the outstanding need at the moment is standardization of descriptive terms of road conditions and the development of a rapid and simple method of acquiring and disseminating weather and road information on a fixed schedule. Highway users can well use the information that may be reported in a simple "road code." Table I lists the various breakdowns of elements that could be transmitted in such a code in the manner illustrated in Fig. 4, which shows a fictitious storm situation over Pennsylvania.

Information to be reported can be supplied by many sources. Outstanding among these are the state police and the bus lines which drive, or plan to drive, the major highways 24 hours a day in vehicles equipped with two-way radios. Offices of the Weather Bureau can furnish the necessary weather information, while automobile clubs and all-night garages and service stations can supply any additional road information required.

Probably the best agency in each state for collecting, processing and distributing the information is the Weather Bureau. The necessary reports can be obtained from the offices of the state police and the bus companies or by monitoring the police and bus broadcast bands. Radio and teletype dissemination of the coded information can be initiated within a few minutes of receipt of observations. In the case of radio transmission, it would be preferable to have the broadcast on a commercial wave length so that it could be received on car and home radios. When weather and road conditions are entirely satisfactory, a statement to that effect can be made and the code message omitted.

The benefits to be gained from widespread dissemination of current weather and road information will easily pay for such a service. Accidents can be reduced in number since the motorist, realizing that he is

(*Continued on page 74*)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[1] Pennsylvania Turnpike Commission, "Summary of Accidents on Pennsylvania Turnpike."

[2] National Safety Council, *Accident Facts*, 1945 edition.

[3] Fitch, Squire E., "Open Roads in New York's Snow Belt," *Public Roads*, vol. 69, 1938.

[4] Wiggin, A. J., "Removing Snow and Controlling Icy Roads in Maine," *Public Works*, vol. 69, 1938.

[5] Finney, E. A., "Snow Drift Control by Highway Design," *Roads and Streets*, vol. 83, no. 3, March 1940.

[6] *American City*, vol. 53, 1938.

[7] National Safety Council, *Accident Facts*, 1941–1946 editions.


**TABLE I. CODE TABLE FOR ROAD CODE**

| Present and Forecast Weather ($W_p$ & $W_f$) | Visibility* | Road Conditions | Driving Conditions |
|---|---|---|---|
| 0. No report or no forecast | 0. No report | 0. No report | 0. No report |
| 1. Weather has no effect upon driving | 1. Good visibility throughout† | 1. Satisfactory | 1. Excellent (safe travel at speed limit) |
| 2. Fog or dust storm | 2. Limited zones of fair visibility† | 2. Congested traffic | 2. Fair (travel time increased 0 to 25 percent above normal travel time)‡ |
| 3. Rain | 3. Limited zones of poor visibility† | 3. Detours (road construction, floods, etc.) | 3. Poor (travel time increased 25 to 50 percent above normal travel time)‡ |
| 4. Snow | 4. Extensive zones of fair visibility†. | 4. Old ice or packed snow | 4. Bad (travel time increased 50 to 75 percent above normal travel time)‡ |
| 5. Drifting snow | 5. Extensive zones of poor visibility† | 5. Drifted snow | 5. Very bad (travel time increased more than 75 percent above normal travel time)‡ |
| 6. Freezing rain, sleet or glaze ice | 6. Zero visibility within section† | 6. New fallen snow, sleet or glare ice on pavement | 6. Impassible |

* Total length of zones of restricted visibility: Limited area = $\frac{1}{2}$ to 5 miles; extensive area = more than 5 miles.

† Visibility is considered good when the maximum is more than 1,500 ft; fair when the maximum is 401 to 1,500 ft; poor when the maximum is 101 to 400 ft; "zero" when the maximum is zero to 100 ft.

‡ Driving time based on truck and bus schedules, safety considerations, etc., for sector of highway.

# Income Tax Requirements Affect Foreign Service of American Engineers

EDMUND H. LANG, ASSOC. M. ASCE
Canal Zone

IN STUDYING the advisability of accepting an assignment in a foreign country American engineers must necessarily consider the effect of the federal personal income tax on their net earnings. Factors such as date of completion of job, risk of disease, inflated costs and temporary or permanent residence in a foreign country affect the amount of income tax that must be paid and influence the engineer's decision to serve outside the country. Information on the provisions of the federal personal income tax law of value to engineers contemplating foreign service is given here.

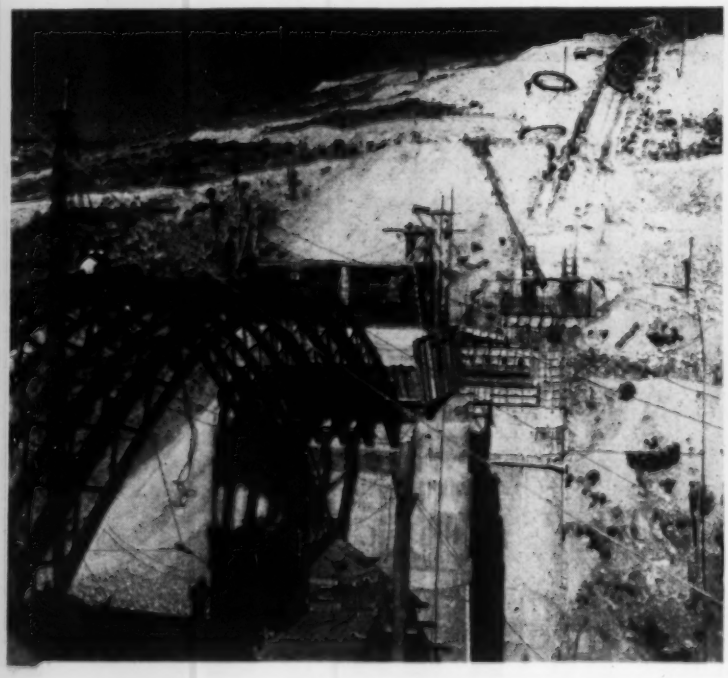
THE ENGINEERING PROFESSION must consider to a greater degree than ever before the matter of foreign employment for its individual members. American funds are being loaned abroad for engineering works, and nations formerly considered backward are acutely aware of the need for engineering and industrial development. Some of the projects planned are of such magnitude that experience gained during their construction will prove an asset to the individual and to the pool of professional knowledge available to the nation.

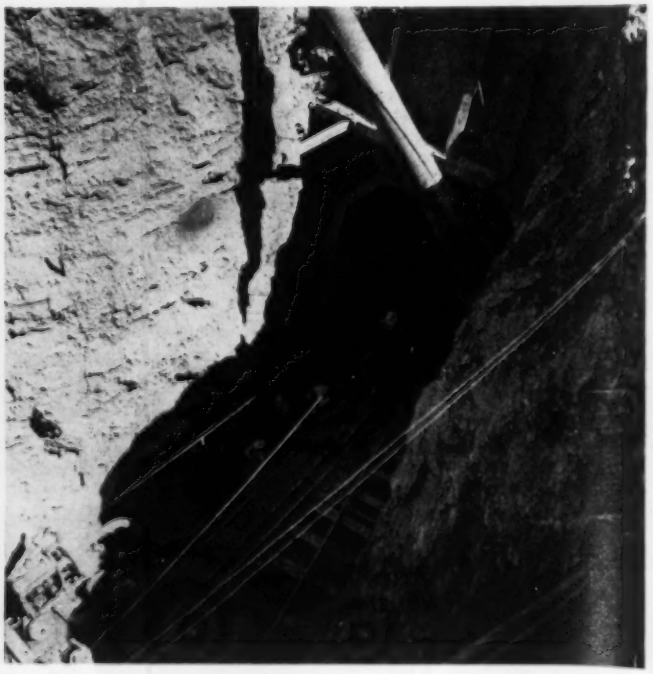
If the profession agrees that foreign experience may be desirable, it should take steps to remove as many of the hazards and objections to such employment as possible. The time for such action is short in view of resurgent competition and the appearance of a European offer in Argentina of engineering services on major works without cost in return for the contract to build the structures and install machinery. One change needed to make foreign employment more attractive to American engineers, and to give them a better competitive advantage, is a revision of certain provisions of the federal personal income tax.

Few engineers have reliable information about the subject and can do little individually toward making desirable changes. Parts of a letter to the writer from the Commissioner of Internal Revenue, under date of May 21, 1947, give the best information seen to date. This letter was written to apply to an engineer employed in a foreign land not a possession of the United States. Venezuela was mentioned as the specific country for purposes of illustration, in the event that special treaties might apply to some other lands. Except for two introductory paragraphs, the text follows:

"Section 116(a)(1) of the Internal Revenue Code provides that an individual citizen of the United States, who establishes to the satisfaction of the Commissioner of Internal Revenue that he is a bona fide resident of a foreign country (or countries) throughout the entire taxable year, may exclude from gross income (income subject to federal taxation) amounts received during such year from sources outside the United States (except amounts paid by the United States or an agency thereof) as

EXPERIENCE GAINED in foreign engineering work is asset to individual and profession. Pictured here are construction views of Valsequillo Valley Irrigation Project in Puebla, Mexico. Steel girders (left) support siphon pipes that carry water across deep arroyo and over hills to open canal. Auxiliary tunnel (right) provides access for materials for building central section of 11-km main irrigation tunnel designed for capacity of 50 cu m per sec. Project which will irrigate 40,000 hectares of farm land in Valsequillo Valley is under direction of Mexican National Irrigation Commission.





OBSTACLES to foreign experience should be removed if profession agrees that such experience is desirable. Pictured here is view of main canal from heights above spillway at Valsequillo Dam, Puebla, Mexico. Dam will store 400,000,000 cu m of water for irrigation of arid land located as far as 100 km down Valsequillo Valley.

compensation for personal services performed by him. The provisions of section 116(a)(1), together with the regulations relating thereto, were carefully considered prior to the issuance of I.T. 3642 (C.B. 1944, page 262). It was concluded that in determining whether United States citizens are bona fide residents of a foreign country or countries within the meaning of section 116(a)(1), mere physical presence in a foreign country for an entire taxable year, or longer, is not of itself sufficient to constitute a United States citizen a bona fide resident of such foreign country for the purpose of section 116(a)(1).

"The legislative history of section 116(a)(1) of the Code amply supports this interpretation. This history shows that its benefits were intended for those citizens who made a career of service in foreign countries. In the origin of this section it was referred to as the "Foreign Trade Exemption," the purpose of which was to encourage foreign trade by exempting from federal income tax (upon certain conditions) the personal service compensation which American citizens earned while engaged in enterprises abroad. (Committee Reports, 69th Congress, 1st Session, on section 213(a)(14) of the Revenue Act of 1926, Part 2 of C.B. 1939-1, 320, 364; also 67 Cong. Rec. 3781; 75 Cong. Rec. 10410; and John Balestreri, 1942, 47 B.T.A. 241, 244, 245.)

"In summary it will be seen that there are four requirements which must be met if the taxpayer is to be allowed the benefits of section 116(a)(1): (1) The income to be excluded must represent compensation for personal services performed outside the United States; (2) the income to be excluded must have been paid other than by the United States or an agency thereof; (3) the taxpayer must have been a bona fide resident of a foreign country (or countries) for the entire taxable year; and (4) he must satisfy the Commissioner of In-

AMERICAN EQUIPMENT and "know how" are used on many foreign projects. Service road section of Guatemala's new 500-km link in Pan-American Highway employs 25 diesel tractors, plus scrapers, sheepsfoot rollers and other heavy equipment developed and manufactured in this country.

PROVISIONS of federal personal income tax favor engineering work performed in U.S. and its possessions. Construction of Allbrook Field, Balboa, Canal Zone, involves removing two hills and excavating 1,000,000 cu yd of material. View shows excavation work on 1,000-ft runway extensions.

NEW SUPERHIGHWAY in Brazil connects Sao Paulo, country's largest city, with Santos, booming port on Atlantic, 50 km away. Highway of double-lane design eliminates tortuous curves and steep grades of present road built by slave labor many decades ago.

ternal Revenue as to the bona fides of his foreign residence.

"The first two requirements are self-explanatory. As to the third requirement, as noted above, if the taxpayer goes to a foreign country to work on an assignment, temporary in its nature, he cannot be classified as a bona fide resident of such country although this assignment requires that he remain therein for the entire taxable year or even longer. If, however, he adopts his foreign residence by reason of substantial and, more or less, permanent circumstances and this residence covers the entire taxable year, he may be classified as a bona fide resident of such country.

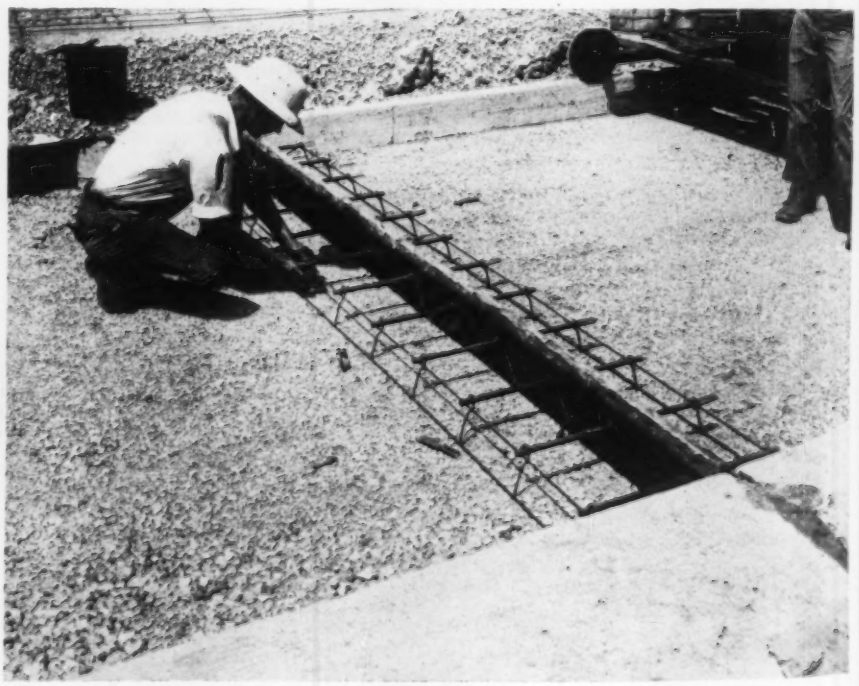
"In connection with this matter of exemption under section 116(a)(1) it should be pointed out that a citizen of the United States taking up residence without the United States in the course of the taxable year is not entitled to the exemption accorded by section 116(a)(1) for such taxable year (Section 29.116-1 of Regulations 111.) Also section 29.116-1 of Regulations 111 provides that if United States citizens have established bona fide residence in a foreign country or countries within the meaning of section 116(a)(1) of the Internal Revenue Code, they shall not necessarily lose that status by reason of temporary absence from the foreign country while on vacation or business trips in the United States. However, any salary earned while in the United States on business trips is fully subject to federal income tax and subject to witholding under section 1622 of the Code.

"Since a blanket ruling cannot be issued covering all cases with respect to the requirement of bona fide residence in a foreign country, it is generally suggested in those cases in which citizens feel they are entitled to the exemption accorded by section 116(a)(1) of the Code, that they file their income tax returns in the usual manner on Form 1040, attaching thereto a statement of all the circumstances pertaining to their foreign sojourn including the date it began, the conditions of their employment or occupation (including the nature and expected duration thereof), the name of their employer (if they are not en-

(*Continued on page 76*)

## *Load Transfer Unit Meets Heavier Wheel-Load Requirements*

HEAVIER WHEEL LOADS on airport runways and highways emphasize need for satisfactory load transfer devices at pavement joints. Plain bar dowel units weighing 84 lb each, developed by Bethlehem Steel Co., are being placed in large quantities in Pennsylvania highway construction. Unit is designed in keeping with modern design factors that combine with paving equipment and technique to require that all dowels in any one joint in pavement be pre-assembled into single substantial unit in which dowels are firmly held in their spacing, alignment and level. Alternate dowels along unit are rigidly welded to one side frame and one center wire and remaining dowels are welded to opposite side frame and center wire. Arrangement permits two halves to be drawn apart for insertion of filler strip, which may be cork, fiber or other compressible materials in expansion joints, and tarred paper, etc., in contraction joints.



# Engineers' Notebook

## Nomograph Chart Aids Pumice-Concrete Slab Design

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Assoc. M. ASCE
Civil Engineer, Design, Inyokern, Calif.

FOR THE CONSTRUCTION of reinforced concrete buildings at the Naval Ordnance Test Station on the Mojave Desert, extensive use is made of light-weight pumice concrete because of its heat insulating properties and other desirable characteristics. The modulus of elasticity of pumice concrete is only 750,000 psi, which gives a structural design value for $n$ of 40. Most design tables and charts are prepared for reinforced concrete having a value of $n$ ranging from 10 to 15 and are useless when designing for pumice concrete.

A nomograph was therefore prepared (Fig. 1) for the design of reinforced concrete slabs using a steel stress of 24,000 psi, an $n$ value of 40, and a choice of concrete stresses ranging from 600 to 1,100 psi. By means of this chart, if any two of four design factors are known, the other two can be obtained.

As an example of the use of the chart, assume that a concrete stress of 1,000 psi is allowable and that the total bending moment in a 1-ft slice of slab is 15.8 ft-kips. It is desired to find effective depth of slab and area of steel required per foot of slab.

Connect 1,000 on Scale 1 (allowable concrete stress) with 15.8 on Scale 3 (bending moment) by a straight line. Intersecting point on Scale 2 indicates 1.2 sq in. of steel required per foot of slab. Statelite scales to the left of Scale 2 indicate that $^3/_4$-in. rounds at $4^1/_2$-in. centers will furnish the required area. The summation of bar perimeters for the spacing, used in bond-stress determinations, is given by the statelite $\Sigma_o$ scale as 6.3 in. per ft of slab. The effective depth is given on Scale 4 as $7^7/_8$ in. Simplified design practice would raise this to 8 in.

The chart can also be used to determine the concrete stress if the effective depth and the steel area are known. Any two points establish the straight line, and the intersection with the other two scales yields the required values.

In the example above, conventional design for the same bending moment and identical allowable stresses in concrete and steel, but with an $n$ factor of 12, gives an effective depth of 10 in. The steel requirement is 0.9 sq in. per ft of slab, which is nearly equal to $^3/_4$-in. rounds at 6-in. centers. The saving of 2 in. in thickness of concrete at the expense of 0.3 sq. in. of steel per foot is not the only benefit derived from the use of pumice concrete. The dead weight of the pumice slab at a unit weight of 110 lb per cu ft is $9^1/_2 \times 110/12 = 87$ lb per sq ft. Conventional concrete slab would weigh $11^1/_2 \times 150/12 = 144$ lb per sq ft. It is immediately apparent that the thinner pumice-concrete slab has a greater live-load carrying capacity of 57 lb per sq ft.

The heat transmission coefficient $U$ for the two slabs, based on a wind velocity on one side of 15 mph and still air on the other side, is 0.576 for the conventional slab and only 0.191 for the pumice slab. The heat loss through the pumice slab is reduced 67 percent. Effectiveness of pumice concrete roof slabs for buildings constructed in the desert is apparent.

Allowable steel stress of 24,000 psi may be considered too high by some designers. By a comparatively routine computation and a simple drafting job, similar alignment charts can be prepared for any value of $f_s$. Tables given in the *Reinforced Concrete Design Handbook* of the American Concrete Institute will be found most helpful in the preparation of nomographs provided they are revised for an $n$ factor of 40.

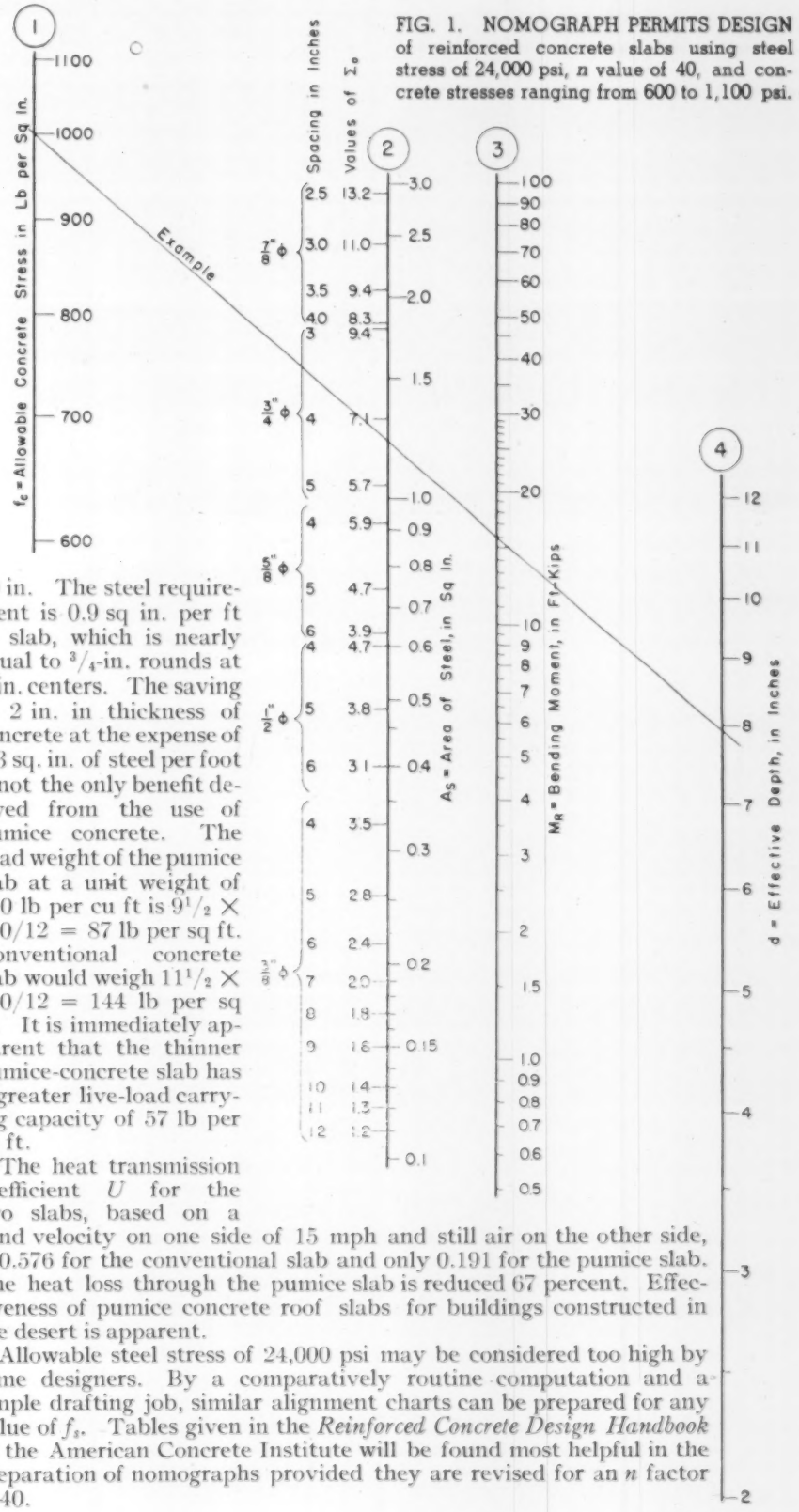
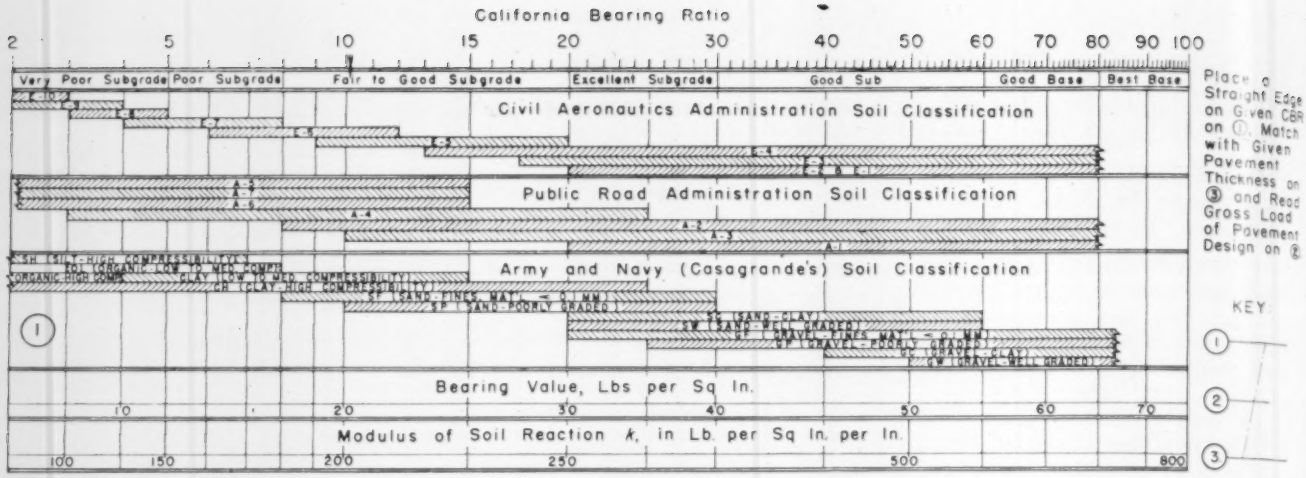


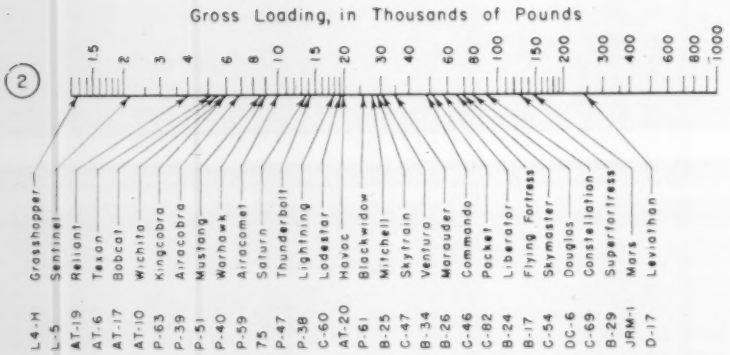

FIG. 1. NOMOGRAPH PERMITS DESIGN of reinforced concrete slabs using steel stress of 24,000 psi, $n$ value of 40, and concrete stresses ranging from 600 to 1,100 psi.

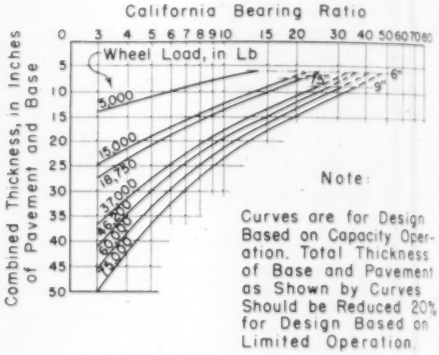

California Bearing Ratio
2 5 10 15 20 30 40 50 60 70 80 90 100
Very Poor Subgrade
Poor Subgrade
Fair to Good Subgrade
Excellent Subgrade
Good Sub
Good Base
Best Base
Civil Aeronautics Administration Soil Classification
Public Road Administration Soil Classification
Army and Navy (Casagrande's) Soil Classification
Bearing Value, Lbs per Sq In.
10 20 30 40 50 60 70
Modulus of Soil Reaction k, in Lb. per Sq In. per In.
100 150 200 250 500 800
Place a Straight Edge on Given CBR on ①, Match with Given Pavement Thickness on ③ and Read Gross Load of Pavement Design on ②
KEY
①
②
③

# Flexible Pavement Evaluation Chart

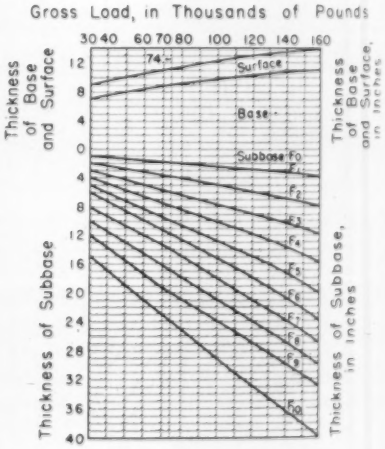

DON LEE

Chief, Soils and Paving Section, Airports Branch, Region IV, Civil Aeronautics Administration, Fort Worth, Tex.



California Bearing Ratio
0 3 4 5 6 7 8 9 10 15 20 30 40 50 60 70 80
Combined Thickness, in Inches of Pavement and Base
Wheel Load, in Lb
5,000
15,000
18,750
27,000
36,000
45,000
60,000
75,000
3"
6"
9"
Note:
Curves are for Design Based on Capacity Operation. Total Thickness of Base and Pavement as Shown by Curves Should be Reduced 20% for Design Based on Limited Operation.

CALIFORNIA METHOD
TENTATIVE DESIGN CURVES
From U.S.E.D. Manual Chap. XX

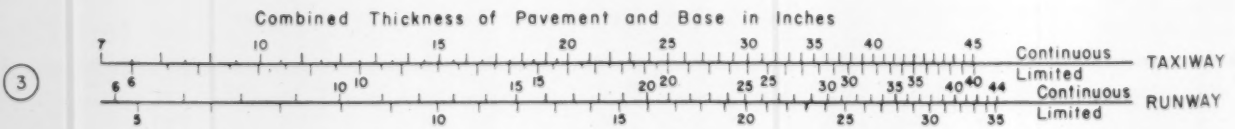

Gross Load, in Thousands of Pounds
30 40 60 70 80 100 120 140 160
Thickness of Base and Surface
Thickness of Subbase
Surface
Base
Subbase
Thickness of Base and Surface, in Inches
Thickness of Subbase, in Inches

FLEXIBLE PAVEMENT
NON-BITUMINOUS BASE
From CAA Design Manual

**KEY AT UPPER RIGHT** explains use of nomograph for determining the capacity of an airport to carry the gross loading of various types of military planes. Basic design curves from which chart was made are also shown, but do not affect evaluation procedure.

THIS CHART WAS DESIGNED and used to evaluate existing airports for military use. It should not be considered a design chart, for even though it follows the basic design curves reproduced herewith, to use it as such would preclude the economies possible through the utilization of select materials in formation of the subgrade and subbase. Design curves allow certain credits, or exact penalties, depending on conditions that do not appear on this evaluation chart. Such refinements often afford large savings.

Interrelationships of the various methods of classifying soils are shown at the top of the chart. The value of good subgrade conditions is quickly demonstrated. As the quality of a subgrade improves, the capacity of the pavement increases, or for a known loading the required pavement thickness decreases.


Combined Thickness of Pavement and Base in Inches
③
7 10 15 20 25 30 35 40 45
Continuous
TAXIWAY
Limited
6 6 10 10 15 15 20 20 25 25 30 30 35 35 40 40 44
Continuous
RUNWAY
Limited
5 10 15 20 25 30 35

# ...THE READERS Write

## Proposed ASCE Grade of "Fellow" Questioned

To the Editor: On page 66 of Civil Engineering for July, under Items 14 and 15, there is a discussion of a proposed new grade of Society membership to be designated as "Fellow." Without reference to the arguments for and against such a new grade, the question is raised as to the designation to apply to the new grade to which it is proposed to advance about 10 percent of the membership.

While the designation "Fellow" is known to be used by certain scientific societies (principally in England), it is not recognized by the general public in this country as a designation of distinction. The reason for this is that the term has been commonly used as applying to men of less than ordinary achievements. Webster's dictionary defines the term as follows: "(1) An equal, associate, partner; (2) A person of one of the lower social orders, the common form of address in the past to servants and inferiors; (3) A man without good breeding or worth." While the last two designations are considered obsolete, nevertheless the term is still used in a familiar or derogatory sense—that is, a jovial fellow; a worthless fellow. Also, in England where the term is more common, it designates a young man at the beginning of his career.

Why adopt a term that will leave a question in some minds and lead to ridicule in others, when there are terms that everyone accepts as honorable and carrying a note of distinction. One such is the designation "Dean." The original meaning of dean was "a chief or head of ten men." As now used by Americans, it designates one who is chief of a group, either for administrative purposes or by reason of long service, and is a term of courtesy and, in many cases, of affection. Never has it had a derogatory or derisive meaning. Other terms that might be considered are: "chief, principal, senior, don, captain," etc., but to each of these there are obvious objections that make them inappropriate.

Therefore, if a new higher grade of membership is adopted, the designation "Dean" (not dean member) is urged for it as a courteous, dignified, well and favorably recognized American appellation that even the man with the hoe will not question. Also, such a designation will have a constructive influence on those who will have the responsibility of selecting candidates for the distinction.

Harland C. Woods, M. ASCE
*Director, District 3*
*Buffalo, N.Y.*

## Approves Regrading of ASCE Membership and Dues Increase

Dear Sir: I was much interested in reading the discussion on regrading the Society membership in the July issue of Civil Engineering. We went through the same thing a few years ago in the Engineering Institute of Canada.

The view that prevailed at that time was that there should be only one type of corporate membership. From the public viewpoint, membership in a national society could be appreciated but not the finer distinctions of various ranks within the society grading. Or to look at the question selfishly, one's professional status would be enhanced, or otherwise, by the standing of the society as a whole and not by finer gradings that could only be appreciated by other engineers.

If I may express my own personal opinions in more detail, they are:

Students, including those enrolled in engineering colleges, should most decidedly form a definite grade of membership, even if carried by the Society at a small financial loss. In the ordinary course of events, they are the future membership and once connected with the Society should be encouraged to step on up. The smaller student dues should entitle them to at least one of the Society publications, but as they will be carried at a financial loss by headquarters they should be automatically graded up to Junior one year after graduation.

The "Junior" grade of membership should be retained, but it should be a voting or corporate grade. If a Junior is old enough to decide by vote who shall govern him in civil life, he is certainly entitled to have a say as to who shall run his own Society. There are bound to be some who will claim that the Junior should not vote because of his smaller contribution in dues to Society funds. That I think is an excuse, not a valid reason; he is not disenfranchised of his civil vote because of his lower taxes.

I would like to see the Junior grade extended upwards until his experience in his profession is about midway between the present Associate Member and Member grades. At about the age of 33 or 34 he should be automatically transferred to Member grade or should leave the Society. These automatic transfers in the Junior and Student grades should be enforced, as there are always some who try to evade their Society and professional responsibilities by remaining in the lower grades until their grading is ridiculous.

The grade of "Associate Member" should be dropped entirely. For one thing, the term "Associate" does not describe the range of experience prerequisite to the grade; it conveys very little meaning to the public and, if anything, more nearly fits the Affiliate qualifications. It was mostly personal reactions of this sort that influenced me a few years ago to take steps to transfer to full Member.

The grade of "Member" should be retained and, under a "grandfather clause," should absorb all members above the grade of Junior. In order not to lower the future qualifications for this grade too much, minimum qualifications should be about midway between the present Associate Member and Member standing.

The proposed grade of "Fellow" for highly qualified engineers seems to me unsatisfactory. The existing grade of "Honorary Member" covers the situation for outstanding men very well and is widely recognized in engineering circles. Also, I have the feeling, perhaps wrongly, that the term "Fellow" as a mark of very high standing has been somewhat abused by some of the non-technical societies.

In regard to the amount of dues, I feel that each of us must make up his own mind as to what he wants the ASCE to undertake for the profession as a whole and for his own personal benefit. Also, each of us will be influenced in this matter by the number of other societies or organizations to which he belongs.

Looking at the matter from a very self-centered point of view, I have always felt that I received more per dollar from the ASCE than from other organizations to which I belong. In this I include both the tangibles, like the publications, and the intangibles such as enhanced status resulting from membership in such a widely known society.

Jasper H. Ings, M. ASCE
*Niagara Falls, Canada*

## Praises Establishment of Applied Science Awards

DEAR SIR: I was interested in the notice, in the September issue, of the formal establishment of the Leon S. Moisseiff Award by the ASCE Board of Direction. It occurred to me that there must be a reason why our Society should establish prizes to encourage improvements in the applied sciences. The answer seemed to be that such prizes are established for the welfare of man.

The question then arises: Have the applied sciences furthered the welfare of man? I have tried to answer my own question in the following paragraphs, which contain data from a synopsis of the 875-page Twentieth Century report published in *Engineering News-Record* for May 15, 1947.

In the century 1847 to 1947 the improvements in the applied sciences used to make production in industry have increased the animal and mechanical power used per worker from $\frac{1}{2}$ hp to 3 hp. As a result, the physical units produced per man hour per worker have increased fivefold. The work time in 1847 was 72 hours per week, while in 1947 the average work time was 44 hours.

In 1850 man supplied 15 percent of the work energy; machinery, 6 percent; and animals, 79 percent. In 1947 man supplied 3 percent of the work energy; machinery, 94 percent; and animals, 3 percent.

In the century from 1947 to 2047 man will have the knowledge that matter everywhere is fundamentally the same, that its form comes from the arrangements of its electrons, and that the breakup of matter releases enormous power. Man will use this power and improve other power to greatly increase the horsepower aid to each worker, who should thereby produce more than double the present production per worker hour. Thus we may expect that by 2047, in a 20-hour work week, a worker may get for his work sufficient income to enable him to provide for his family. At that stage of development, the desire to get additional property may cease as excess property becomes a useless burden.

Improved medical and health conditions have resulted as measured by the yearly mortality. For each 1,000 living persons, 24 died in a year in 1850; 17 in 1900; and 10.5 in 1942. In 1850 men and women 65 years or over constituted 3 percent of the population, and in 1947, 7 percent.

I personally believe the material betterment of mankind comes directly from the increase in production through safer and improved methods in industry established by our scientists and engineers. Political organizations, unions, or governments of any type merely make regulations and laws for a system under which the products are distributed, but they do not make the production.

I would select a system of democratic government like that in the United States as the best system to produce a greater percentage of individuals with personal initiative who will create new and better applied inventions. The reason is clear. Such individuals can function without oppression, and the standards all around them are those erected in a free society.

H. G. Wells, in his *Outline of History*, described Buddha, who lived 2,500 years ago, as one of the most penetrating intellects that ever lived and states his teachings are in the closest harmony with modern ideas. Buddha described man as (1) selfish, (2) ambitious and (3) desirous of acquiring property. He said that those who eliminate these three properties could reach Nirvana, the state of peaceful contemplation, which he considered the best state. The applied sciences, as I see it, promise to eliminate the desire for property acquirement in the twenty-first century for the first time in our history. What will man do should this happen?

Perhaps the Society should include on its prize certificate the accomplishments in the applied sciences.

CHARLES GOODMAN, M. ASCE

*New York, N.Y.*

## Civil Engineers Lauded in Poem by Member

TO THE EDITOR: The following original poem, entitled "Conquest," may possibly be of interest in the columns of CIVIL ENGINEERING, which are not devoted entirely to the purely technical phases of the engineer's activities:

"Spurning the spell of distance, cleaving across the land,
Binding mankind's far outposts to all the human scheme,
Cutting the shifting landscape, the highway's level band
Winds through the mountains' passes and over the sluggish stream

That curls beneath the arches of a bridge's rhythmic span
Down to the mighty gorges in the valley far below,
Where the river's surging torrent is tamed by the will of man,
Balked by the Titan masses of the dam that stems its flow.

The dam that leashes power to turn the distant wheel,
That makes lights glow in cities far—the road that links all near;
The bridge that spans the chasm—all are monuments that seal
The triumph over nature by the Civil Engineer!"

ERIC FLEMING, M. ASCE

*New Brunswick, N.J.*

## Previous Discoveries in "Rod Waving" Cited

DEAR SIR: The article, "Level Men Cautioned on 'Waving the Rod,'" by H. S. Rappleye, in the April issue of CIVIL ENGINEERING, interests me because the same phenomenon caused me to contribute an article, "A Curious Case of Spurious Reading in Levelling," to the June 1939 issue of *The Australian Surveyor*.

What is more interesting is that I discovered, after taking up a teaching appointment at the University of Melbourne in 1940, that my "original" discovery had already been dealt with in a textbook entitled *Surveying*—by W. N. Thomas, of Birmingham University—published in 1920 by Edward Arnold, of London. After finding myself in the company of such a reputable authority as Mr. Rappleye as partners in originality, I don't feel quite so sore about it.

One point where we do differ however, is that Mr. Rappleye's treatment makes the "false minimum" occur when $\tan \alpha = A/R$. Should it not occur when $\sin \alpha = A/R$?

$$\text{True reading} = R = (\text{false reading}) \cos \alpha + A \sin \alpha.$$

i.e., False reading $= R \sec \alpha - A \tan \alpha$.

i.e., Error in reading = false − true = $R \sec \alpha - A \tan \alpha - R = E'$ ($E'$ is used to distinguish it from Mr. Rappleye's $E/\cos \alpha$).

$$\frac{dE'}{d\alpha} = \frac{R \sin \alpha}{\cos^2 \alpha} - \frac{A}{\cos^2 \alpha}$$

$E'$ is a maximum when $R \sin \alpha = A$.

This occurs when the intersection of line of sight and face of rod is vertically about the point of rotation of the heel of the rod.

The worst error, for a true height of $R$, occurs when $E' = R \sec \alpha - R \sin \alpha \tan \alpha - R = -R(1 - \cos \alpha) = -R$ versine $\alpha$.

Assuming $A = 0.15'$, and calculating values of $\alpha$ and $E'$ for various values of $R$, gives the results shown in the following tabulation:

| $R$ ft | $\alpha$ | $E'$ ft |
|---|---|---|
| 0.2 | 48°35′ | 0.0677 |
| 0.5 | 17°27′ | 0.0230 |
| 1.0 | 8°38′ | 0.0113 |
| 3.0 | 2°52′ | 0.0038 |
| 5.0 | 1°43′ | 0.0022 |
| 7.0 | 1°14′ | 0.0016 |
| 10.0 | 0°52′ | 0.0011 |
| 13.0 | 0°40′ | 0.0009 |

These results differ from Mr. Rappleye's for rod readings below 3 ft.

G. J. THORNTON SMITH
*Senior Lecturer in Surveying, University of Melbourne*

*Melbourne, Australia*

# Engineers Have Little Chance to Enter Politics

DEAR SIR: The article by William Goldsmith, "Politics Needs Engineers," in the August issue, repeats the familiar theme of self-criticism in which the engineering profession is prone to indulge. I would not wish to discourage such goads to our conscience, but I do feel that Mr. Goldsmith overdraws the picture somewhat in the extent to which he indicates the engineer is to blame for his insignificant part in public affairs.

It is, of course, regrettable that engineers are not better represented in Congress, that they do not participate to a greater extent in the policy-making government service, that they take so little direct political action. I must challenge, however, the statements that "A large part of the blame is undoubtedly due to the fact that engineers, like so many other people, tend to look down on politics and politicians and fail to realize the important part that politics plays in the world today"; that "(the engineer) has... failed to appreciate or give due credit to the function and accomplishments of men in political life"; and that he does not recognize his responsibility to participate in the affairs of government.

By implication, if the above is true, the converse must be true of lawyers and judges, since they contribute 303 of the 531 members of Congress. Without malice towards the legal profession, I must reject this corollary thought. Why does a young man, or any man, enter politics? Because he feels it a responsibility, a duty? In some cases, yes; but, in general, it is because he anticipates a successful future, offering him the rewards that he would seek in most other jobs.

Let us compare the opportunities for, and the rewards of, political activity in the case of two men, one an engineer and one a lawyer, both recent university graduates. It is certainly true that political activity helps a young lawyer, for he makes a large number of friends, any of whom may later become his clients or may send clients his way. Furthermore, his legal work usually requires him to come in contact with a number of people, some of whom may be influential in politics. His legal and political activity thus go hand in hand, complementing and reinforcing each other. Our young engineer, on the other hand, whether working in a design office or on a construction job, rarely has occasion to meet or talk with many people in the course of his work. Nor would such contacts, except those with other engineers, be apt to advance him in his field.

A lawyer usually makes few changes in his residence. He remains in one town or city, votes, is a member of fraternal, service, and church organizations, becomes well known to an ever-increasing group of people. Young civil engineers, as well as many in the other branches of engineering, are not likely to remain in one place for long. The nature of civil engineering work is transient, and advancement often hinges on a man's willingness to change jobs. His short terms of residence make it difficult for him even to be an informed voter—if, indeed, he is permitted to vote at all— and he has little opportunity to enter into political activity.

Moreover, a large group of engineers are employed by the federal government and are forbidden by law from engaging in any political activity whatsoever.

Finally, what sort of political appointment or elective office can the engineer aspire to as compared with the lawyer? I have tabulated the appointive and elective offices of the State and City of New York, as listed in the 1947 World Almanac, which pay over $10,000 and over $20,000 per annum. Of those listed, some jobs (such as governor, mayor, heads of most departments) are presumably open to any citizen, but the overwhelming majority (mostly judgeships) can be filled only by qualified attorneys.

| | $10,000 and Over | $20,000 and Over |
|---|---|---|
| **NEW YORK STATE** | | |
| Open to anyone | 38 | 4 |
| Physicians only | 2 | .. |
| Attorneys only | 142 | 80 |
| Total | 182 | 84 |
| **NEW YORK CITY** | | |
| Open to anyone | 52 | 3 |
| Physicians only | 2 | .. |
| Attorneys only | 191 | 29 |
| Total | 245 | 32 |

There may, of course, be a number of well-paid Civil Service positions open to engineers, but these would not ordinarily be the reward of political activity.

WILSON V. BINGER, Jun. ASCE
*Chief, Soils and Foundations Section, The Panama Canal*
*Diablo Heights, C.Z.*

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# Is Satisfied with Ratio of Engineers in Politics

DEAR SIR: The figures furnished by former Commissioner William Goldsmith in his article, "Politics Needs Engineers," in the August issue of CIVIL ENGINEERING, make me happy. I am satisfied with the 3-to-303 ratio of engineers to Congressmen. This explains the reason why there is construction progress in the country, despite the cruel reality that the reins of political power are in the hands of lawyers.

An engineer cannot be anything but an engineer, unless he has forsaken the profession or has retired. If his mind is on complex theories, out of which he has to produce working machines, and if he has to translate the stresses and strains of intricate frames into mathematical language in order to ensure a safe, attractive, and economical structure, how can he be interested in wrangling with lawyers, generals, and others, whose habitat is the political field? They are out to solve problems they create themselves. The task of the engineer is a noble and humanitarian one. The engineer creates comfort and eliminates hardships for all.

The real engineer produces designs with brain and pencil—figure after figure, line after line, in sketch and detail, with knowledge and art, and with ingenuity and efficiency. His job is both work and recreation, the one ambition to be fulfilled. So important is his work that he seldom takes his lunch at a regular hour, and figuring out his salary would be a waste of time.

Once the engineer becomes a supervisor, chief, or director (opportunities for these positions have micrometric limitations) he has ceased to be an engineer, for though he may conceive plans and make outlines and sketches, he will never deliver the goods. His function is to advise and demand, not to achieve. Now he has time to write, to make speeches, to attend conventions, and even to enter politics. But will he serve humanity? Will he serve the engineer? That remains a question, for he has long ceased to be an engineer.

My moral is that it makes no difference who is in politics. It is not the man who spoils the state; it is the state that perverts the man.

G. F. RAMIREZ, Assoc. M. ASCE
*New York, N.Y.*

# SOCIETY NEWS

EDITORIAL

## Responsibility and Opportunity

LIKE ALL RIGHTS and privileges, the freedom from compulsory unionism recently won by professional engineers carries with it a compensating responsibility. In this case, it is the responsibility to demonstrate that their relationship with management can be maintained on a plane consistent with the ideals of professional men whose training particularly fits them to understand the problems of management.

This is equally true whether the relationship is between an individual professional man and management, or whether the relationship is maintained collectively through a bargaining unit composed of professional engineers. Instances of the latter may be more infrequent under the Taft-Hartley Act than under the Wagner Act, as the new law specifically defines a professional employee, sets him apart from non-professionals, and gives him, as a right, the option of joining, or refraining from joining, a collective bargaining unit of his own choice. The Wagner Act left the professional employee's status to the discretion of the National Labor Relations Board, and in many instances he found it necessary to join a labor union in order to retain his job, despite the fact that he had no mutuality of interest with a majority of the members of the collective bargaining unit.

The improved status of the professional engineer under the new law was won only after a long, difficult fight against conditions which were, at times, demoralizing, to say the least. Under the banner of Engineers Joint Council, the climactic presentation of the professional engineer's position was made by a panel representing some 100,000 such professional men. The ASCE is proud of the consistent and long-standing leadership it provided during the trying years leading up to that panel presentation.

That the expenditures of time, money, and individual and collective effort not only were justified, but essential, is the consensus among professional engineers throughout the country. It must be gratifying indeed to those ASCE members who devoted their time and energies toward elimination of the vexing conditions that prevailed under the Wagner Act.

There is another result to be anticipated from the new-found freedom of the professional engineer under the country's new labor law. That is the improved and unrestricted opportunity management will have to study the engineer as an individual, rather than as a member of a heterogeneous labor union. Engineers long have been a vital potential source of recruitment for many positions in management, and the new law gives both the individual and management a better opportunity to recognize that fact.

So the future definitely is brighter for the professional engineer in so far as labor relations are concerned—so much so, in fact, that upon recommendation of its Committee on Employment Conditions, the ASCE Board of Direction is recommending to Local Sections that amendments to provide for the setting up of local groups of professional engineering employees to deal with labor-management problems be deleted from their constitutions. At the same time, the suggestion is made to these Local Sections that they continue to maintain an alert Committee on Employment Conditions.

As for the national Society, it will continue its previously expressed policy—that it "give all practicable assistance to its members in the field of collective bargaining and that the Secretary be instructed to render this assistance as effectively as funds, staff, facilities, and legal limitations will allow."

## Engineers Joint Council Represented at Zurich

IN FURTHERANCE OF plans for a permanent World Engineering Conference in which American engineers are playing a leading role, Stewart E. Reimel, secretary of the committee on international relations of the Engineers Joint Council, represented the United States National Committee at a recent meeting of the council and executive board of the Conference in Zurich, Switzerland.

Provisional plans for the international technical body were made at a meeting of engineers and scientists held in Paris last September. The U.S. committee is sponsored by the American Society of Civil Engineers, the American Society of Mechanical Engineers and the American Institute of Chemical Engineers (CIVIL ENGINEERING, September 1947, page 51). Some 50 or more other U.S. engineering societies will be invited to join.

Eight other nations signed the minutes at the Paris meeting, and others are expected to come in, making the project world wide in scope. The advancement of engineering knowledge and the exchange of technical information among countries for the benefit of all are aims of the Conference.

## Cleveland Section Plans Group Travel to Meeting

AN OPPORTUNITY for members to enjoy special group Pullman facilities in traveling to the ASCE Fall Meeting in Jacksonville, Fla., is being provided by the Cleveland Section through arrangements made by its secretary-treasurer, A. D. Yanda, with the Southern Railway System and the New York Central System. If a sufficient number congregate on the same date at Cleveland or Cincinnati, special through Pullman equipment will be furnished by the railroads. Group travel affords many social advantages and gives members a chance to begin meeting activities upon train departure.

To apprise its members of this plan, the Section sent out a mimeographed letter urging them to mail requests for reservations promptly to the secretary-treasurer. Further information on the operation of this plan of group travel to a Society meeting may be secured from A. D. Yanda, Secretary and Treasurer, Cleveland Section, ASCE, 1022 Carnegie Avenue, Cleveland, Ohio.

# NOTES FROM THE *Capital*

E. L. CHANDLER, M. ASCE
Eastern Representative, ASCE

**IN ADDITION TO passing the Taft-Hartley Act (CIVIL ENGINEERING for July, page 48) the 80th Congress considered several other legislative matters of particular interest to the engineering profession. Briefly, these are discussed here.**

## INTERNATIONAL INTERCHANGE AND INFORMATION ACT OF 1947

H.R. 3342, KNOWN as the Mundt bill, is the successor of the Bloom bill of the 79th Congress. Both the ASCE and Engineers Joint Council objected to certain provisions of the earlier bill. That measure would have authorized participation on a large scale by U.S. governmental domestic agencies in the solution of the technical problems of foreign nations. It was considered that such activity was not appropriate for domestic agencies and that it would lead to unfortunate foreign complications. Neither did it seem that adequate assurance was afforded for providing the best technical assistance available, in the event that the United States were to undertake to meet requests from other countries for technical aid. As a result of conferences between committees of the ASCE and officials of the State Department, sections of the bill were so rewritten as to remove these objections. The bill was passed in the House, but never came before the Senate for action. Further consideration is expected in the current Congress.

## STREAM POLLUTION CONTROL

A NUMBER OF bills on this subject were introduced. These finally simmered down to S. 418, which has been passed by the Senate and now rests in the hands of the House Committee on Public Works. Further action is to be expected.

Testimony was presented on behalf of the Society in both the 79th and 80th Congresses. Opposition was voiced to federal grants-in-aid and exception was taken to the procedure under which federal suit for abatement of pollution could be brought in arbitrary fashion at the request of the Surgeon General of the U.S. Public Health Service. It was recommended that, in the event of the federal government's participation in any programs for construction of treatment works, the supervision of such programs should be delegated to the Federal Works Agency rather than to establish a new organization in the Federal Security Agency.

The present bill is more closely in accord with recommendations of the Society than anything previously introduced. It provides for the loan of federal funds under appropriate conditions but not for grants-in-aid. Under its terms the U.S. Public Health Service would be responsible for the health features of the program, but the Federal Works Administrator would administer all engineering and construction. It still would be possible for the federal government to bring suit for abatement, but the procedure is hedged about with safeguards, and suit could be brought only with the consent of an appropriate state agency.

## BILLS RELATING TO THE ARMED SERVICES

SEVERAL BILLS SETTING up new procedures with regard to officers of the armed forces were enacted into law.

H.R. 3215, which has become Public Law 337, creates a Medical Service Corps in the Medical Department of the Army. Under its provisions sanitary engineers are relegated to a rather obscure status, being combined with certain other groups in the Medical Service Corps. As enacted, the law affords sanitary engineers a somewhat better status than was proposed originally, inasmuch as there will be a Sanitary Engineering Section in the Corps. In spite of that fact, the new arrangement can hardly be considered as giving the engineers recognition compatible with the importance of their service.

H.R. 3830, which has become Public Law 381, and S. 1661, which has become Public Law 365, grant special emoluments to medical officers and some others, but include no like provisions for engineering officers. The U.S Public Health Service is affected by reason of its relation to the armed forces. Special recognition accorded the medical officers has been based largely on assertion that it has been found impossible to attract competent personnel in sufficient numbers to meet the requirements of the services.

## CONGRESSIONAL INVESTIGATING COMMITTEES

INVESTIGATION APPEARS TO be the order of the day, and the construction industry is much in the limelight. Two committees are particularly active in the field. A joint committee of the House and Senate, under the chairmanship of Congressman Ralph A. Gamble of New York, is getting under way on an inquiry into all phases of the housing situation. Congressman Ralph W. Gwinn, of New York, is chairman of a committee to investigate restrictive practices in the construction industry. Each committee will conduct hearings in a number of the larger cities throughout the country. Engineers can perform valuable service by cooperating with these committees.

## VETERANS HOSPITAL PROGRAM

A MATTER OF particular interest to engineers, although not in the category of legislation, concerns recent activities by the Veterans Administration which is looking toward change in the present procedure by carrying out, with its own staff, the design of some remaining 15 large hospitals contemplated for the 1948 program. The activities apparently resulted from widespread dissatisfaction expressed over delays in the program as undertaken for the Veterans Administration by the Corps of Engineers. The Corps followed the practice of negotiating with private engineer-architect offices for the actual design, but encountered extreme difficulty in obtaining bids from contractors within the limits of available appropriations. Just how this portion of the program eventually will be administered still is a question, and it is anticipated that when Congress reconvenes that body will look into the matter.

# Freeman Fund Given for Study of Channel Control

FIRST ASCE Freeman Fund award since 1940 has been made to Lt. Col. George F. Dixon, Corps of Engineers, now taking postgraduate work at Cornell University, for a study of European installations to maintain harbor channel depths by induced scouring.

Announcement of the award is made by Malcolm Pirnie, chairman of the Freeman Fund Committee, following ratification by the ASCE Board of Direction. Titled "Investigation of European Method of Harbor Channel Control by the Use of Regulatory Works," Colonel Dixon's project is aimed at study of methods employed at Bremerhaven, Bremen, Rouen, Havre, and Ostend.

United States harbor channels require $25,000,000 of dredging work annually by the Corps of Engineers, and Colonel Dixon's project will be a study of possible savings that may be effected. In his work he will do research at the Technical University in Karlsruhe and the Berlin Experimental Establishment for Hydraulic Engineering and Shipbuilding.

Established in 1924 by the late John R. Freeman, Past-President and Honorary Member of ASCE, the fund originally contained a $25,000 donation made by Mr. Freeman. Interest from the fund is used by the ASCE in encouraging hydraulics studies, particularly by young engineers.

# Streamlining of Membership Application Procedure Effected Through Amendment of By-Laws

To PROVIDE MORE rapid facilitation of membership applications, the ASCE Board of Direction has amended the Society's By-Laws.

Action to streamline the Society's procedure for considering membership applications was taken by the Board of Direction on recommendation of a Special Committee on Simplification of Application Procedure, which has been studying the matter the better part of a year. The committee, headed by Vice-President Arthur W. Harrington, as chairman, was made up of Directors H. T. Critchlow and Maj. Irving V. A. Huie, and included three members of the Society at large—James H. Allen, Philadelphia; B. L. Bigwood, Hartford, Conn.; and Dean G. Edwards, New York City.

In presenting the committee's recommendations for changes in the Society By-Laws, Chairman Harrington emphasized that standards of qualifications are to be maintained at their current high level; that continued cooperation of the entire ASCE membership is essential, both when called upon directly as reference and through careful scrutiny of the lists of prospective members and proposed membership transfers as published in CIVIL ENGINEERING; and that it is intended that any doubt as to the ability or character of an applicant will continue to be resolved in favor of the Society.

### Careful Study of Procedure Made

Members of the committee, which was authorized by the Board at the Fall Meeting in Kansas City last October, made a thorough study of the Society's long-standing procedure for handling applications. In cooperation with the Executive Secretary and his staff, the committee reviewed some 37 forms now used in checking references, requesting additional information, verifying experience and education records, etc. Conclusions reached were that, under normal conditions (available stenographic and clerical help) and with reasonably prompt response from references, including Local Qualifications Committees, the period from receipt of application to election is about four months. Unfavorable condition of the labor market, together with the current large number of applications, has lengthened the normal four-month period in many cases. These conditions, together with difficulties encountered in special cases, involving, for example, foreign mailing or the necessity of obtaining additional Corporate references, consequently have resulted in delays which both applicants and their ASCE member sponsors have found disheartening.

In reporting to the Board, the Special Committee pointed out: "The need for simplification of application procedures relates not only to the desirability of shortening the time required for election, but also to the reduction of the vast amount of detail work now required, uniformly arduous for every applicant, regardless of his experience and qualifications. It is believed that in a large majority of cases a less detailed and time-consuming review of the applicant's record would indicate his eligibility for election."

The Committee was convinced that there are many applicants so eminently qualified for membership that they should be elected without the necessity for the present prolonged investigational procedure.

### Committee Recommendations

Accordingly, the Committee recommended that:

**A preliminary "screening" of applications be provided and investigational work be reduced to a minimum on cases which would ultimately prove to be "clear cases."**

**Complete elimination of formal investigational work on cases where the applicant is eminently qualified.**

To effectuate these recommendations, the By-Laws were amended, on recommendation of the Special Committee, to:

**Establish a Committee on Application Classification, comprised of a member of the Committee on Membership Qualifications who is resident in or near New York City, who will be considered as chairman of the Committee, and two members or past members of the Board of Direction, resident in or near New York City and who preferably have served on the Membership Qualifications Committee.**

**Provide for meetings of the new Committee at Society Headquarters not less than once each month.**

**Empower the Committee to review preliminary work done on applications submitted to it for review and to determine the classification of each case as follows: Class A, applicants deemed to be "eminently qualified"; Class B, applicants deemed to be "apparently qualified"; and Class C, applicants whose cases should be processed in accordance with membership provisions now set forth in Article I of the By-Laws.**

Each week Society Headquarters will forward to every member of the Board of Direction a roster, briefing applications received at Headquarters during the preceding week. The information shown will consist of the applicant's name, business affiliation (address, title, etc.), grade applied for, and Corporate references. Board members will return the roster with an indication of those known to them who, in their opinion, are unquestionably qualified. These reports and the corresponding applications will be reviewed by the Committee on Application Classification and those applicants deemed eminently qualified will be considered to be in Class A, and their applications will go to ballot.

Applications of those who do not fall into class A, will be briefed on a form and sent to not more than five Corporate references (two Corporate references for Juniors) and to the Local Qualifications Committee affected. Endorsement by 80 percent of the required number of Corporate references, but not less than four, and by the Local Qualifications Committee, will place an applicant in Class B. It is believed by the Special Committee that a large majority of applicants will be favorably recommended on the basis of a brief identification, rather than requiring as formerly, that a detailed abstract of each applicant's record be prepared, edited and mimeographed to the extent of 100 copies per applicant.

At each meeting of the Committee on Application Classification, a review is to be made of applications considered to be in Class B and final decisions will be made as to such classification.

### Applications Submitted to Ballot

All applications in Classes A and B will be submitted to ballot on the next ballot following a meeting of the Committee on Application Classfication. All other applications (Class C) will be processed in accordance with established procedure, except that further reports from Corporate references who have already replied will not be requested unless warranted by special circumstances.

Reduction of detail work in the majority of applications, effecting substantial reduction in the period between application receipt and election, with no lowering of membership standards, was predicted by the Special Committee in recommending the By-Law changes to the Board.

President Hastings, under authorization by the Board of Direction, has appointed Director Albert G. Haertlein, Cambridge, Mass., chairman of the Com-

mittee on Application Classification, and Deans S. Edwards and Van Tuyl Boughton, both of New York City, as members. To insure an attendance of three at all meetings, Charles Gilman and Col. William J. Shea, both of New York City, have been named alternate members of the committee.

## Two Resolutions Recognize Aid to Professional Employees

ENACTMENT OF LEGISLATION revising the National Labor Relations Act and emancipating professional engineering employees from compulsion to join labor organizations not of their own choice resulted in the adoption of two resolutions—one by the Board of Direction and one by the District of Columbia Section of ASCE.

The resolution adopted by the Board is in appreciation of the assistance given the Society by Congressman Carl Hinshaw of California, Assoc. M. ASCE, in connection with enactment of the Labor Management Relations Act of 1947. The District of Columbia Section resolution, which was submitted to the Board of Direction and approved, commends E. L. Chandler, Eastern Representative, ASCE, and the chairman and members of the ASCE Employment Conditions Committee and others who "have contributed to the successful outcome for their endeavors on behalf of the professional employees."

The resolution adopted by the Board and sent to Congressman Hinshaw follows:

"WHEREAS, the American Society of Civil Engineers has been gravely concerned about the situation of engineering employees under coverage of the National Labor Relations Act of 1935, and

"WHEREAS, the Society has long advocated revision of that Act to the end that the rights of professional employees might be protected against undesirable practices of labor unions, and

"WHEREAS, the Society is gratified that appropriate provisions have been incorporated in the recently enacted Labor Management Relations Act, 1947, and

"WHEREAS, Congressman Carl Hinshaw, Assoc. M. ASCE, introduced and actively supported in the House of Representatives a legislative bill on which the above-mentioned provisions were based, now therefore be it

"*Resolved*, that the Board of Direction of the American Society of Civil Engineers, assembled in regular session on July 15, 1947, records its appreciation of Congressman Hinshaw's sympathetic understanding of the problems confronting professional employees and of his public-spirited service in this important matter, and be it further

"*Resolved*, that the Executive Secretary be instructed to present a copy of this resolution to Congressman Hinshaw together with an appropriate letter of transmittal on behalf of the Board."

## Improved Technical Meetings Seen Through New Scheduling Method

GREATER UNIFORMITY and general improvement of technical meetings are the objectives of a change in procedure adopted by the ASCE Board of Direction. After consultation with the 13 Technical Division chairmen, the Committee on Division Activities recommended, and the Board adopted, the following major changes in technical meeting procedure:

Specific clearance and authority for the conducting of any Technical Division meeting or Technical Division session must be requested of the Executive Secretary at least four months prior to the date on which the program is to be given, and the proposed tentative program of such meeting shall be submitted to the Executive Secretary for transmittal to the Committee on Division Activities at least that far in advance of proposed sessions.

Papers shall be reviewed for acceptance by the Executive Committee of each respective Technical Division, and when so accepted shall be submitted to the Executive Secretary not less than 45 days prior to any meeting of the Society at which such papers are to be presented. If the foregoing procedure is not complied with, the Committee on Division Activities may cancel the meeting affected.

Not later than September 30 of each year (end of the Society's fiscal year), the chairman of each Technical Division shall submit to the Secretary the Division's annual report, which shall be accompanied by the proposed program of that Division for the succeeding year. The reports are to be transmitted by the Secretary to the Committee on Division Activities, for review and recommendations, and for transmittal by the Committee to the Board.

# NEWS OF LOCAL SECTIONS

## Coming Events

**Alabama**—All-day joint meeting with the Alabama Polytechnic Institute Student Chapter and the University of Alabama Student Chapter will be held on the campus of the University of Alabama, Tuscaloosa, Ala., October 31. Registration and inspection trip in the morning. Afternoon technical session will feature papers by Student Chapter members. Dinner meeting in the evening will be followed by a dance sponsored by the engineering college of the university. ASCE Executive Secretary William N. Carey will be the principal speaker.

**Los Angeles**—Annual Ladies Night at the Rainbow Isle of the Mayfair Hotel, Los Angeles, November 12, at 8 p.m.

**Maryland**—Meeting at the Engineers Club, Baltimore, October 8, at 8 p.m. ASCE President E. M. Hastings will be the principal speaker. Meeting will be preceded by cocktails at 6 p.m. and dinner at 7 p.m.

**Metropolitan**—Meeting in the Engineering Societies Building, New York, October 15, at 8 p.m.

**Mid-South**—Meeting at the Hotel Claridge, Memphis, Tenn., October 24, 9:30 a.m. to 5 p.m. There will be morning and afternoon technical sessions and a luncheon meeting.

**Northwestern**—Dinner meeting at the Campus Club, University of Minnesota, Minneapolis, October 6, at 6:30 p.m.

**Sacramento**—Regular luncheon meetings at the Elks Club every Tuesday at 12 noon. Except on special occasions, visitors are welcome.

**San Francisco**—Dinner meeting at the Engineers' Club, San Francisco, October 21, at 6 p.m.

### Scheduled ASCE Meetings

FALL MEETING

Jacksonville, Fla., October 15–17
(Board of Direction meets October 13–14)

ANNUAL MEETING

New York, N.Y., January 21–23
(Board of Direction meets January 19–20)

## Recent Activities

### ARIZONA

ASCE DIRECTOR John H. Gardiner attended a recent special meeting called to discuss the two proposed amendments to the constitution. Commenting on the proposed dues increase, Mr. Gardiner explained some of the obligations and activities of the Society, and stated that in his opinion a reduction in ASCE annual expenditures can be accomplished only by a reduction in essential interests and activities. There was considerable general discussion from the floor. The technical program consisted of the showing of a sound film on superhighways, which demonstrated present trends in highway requirements.

### BUFFALO

INSPECTION OF the new addition to the DeCew Falls plant of the Ontario Hydroelectric Power Commission featured a meeting with the Peninsula Branch of the Canadian Institute of Engineers on September 11. Approximately 135 Canadian and American engineers toured the 65,000-kw unit, which operates under a 267-ft head. Construction work involved changes in highways, and bridge and channel improvements, in addition to installation of the head works, penstocks and generator. At the dinner meeting that followed the inspection trip, J. R. Montague, hydraulic engineer for the Ontario Hydroelectric Power Commission, and G. F. Simson discussed the details of the project.

### COLORADO

INABILITY TO OBTAIN engineers sufficiently experienced in highway work, together with shortages of equipment and materials, has retarded postwar highway construction in Colorado, according to James Bell, assistant state highway engineer of Colorado. Speaking at the first dinner meeting of the fall season, held in Denver on September 8, Mr. Bell said that another handicap is the increased cost of highway work, which has doubled since 1937. He pointed out, however, that comparative figures on funds, miles of highway constructed and number of projects, analyzed for each year of the past decade, indicate that the State Highway Department has done a very creditable job despite adverse conditions. Total highway construction costs for the state for 1947 are estimated at $22,000,000. In addition to new construction, a total of 800 miles of highway will be reprocessed and sealed with bituminous surface. Mr. Bell's talk was supplemented by a colored moving picture of Colorado construction and maintenance operations, shown by Robert Livingston. Part of the meeting was devoted to discussion of the proposed constitutional amendments.

### FLORIDA

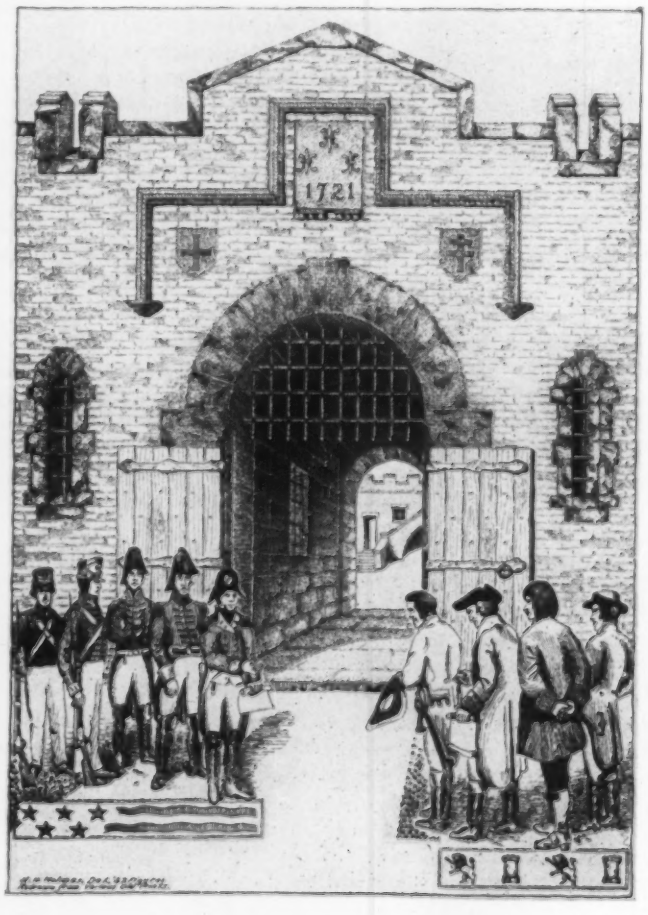
IN LINE WITH previous discussion of the use of light-gage steel material in building construction, members of the Section at a recent meeting recommended that some of the American Institute of Steel Construction specifications be amended to permit the use of thin-gage metal where advisable. It was also recommended that the provisions for revision be put into the new building code being drafted for the city of Jacksonville. Showing of Lincoln Electric Co. films on control of distortion and arc welding design concluded the program. Various types of wood treatment used in combating such destructive agents as termites, dry-rot, marine borers and fire were discussed at the September 11 meeting by F. W. Gottschalk, technical director of the American Lumber and Treating Co., Chicago. Mr. Gottschalk was assisted by O. W. Boehm, Paul Dupree, and M. H. Hamilton—all in the Jacksonville office of the company—who showed slides demonstrating the different types of treatment used. An enthusiastic discussion from the floor was led by Walter Buehler, of Lakeland, Fla.

### PITTSBURGH

A SOCIAL get-together at the Highland Country Club in Pittsburgh constituted the September meeting of the Section. A dozen members played golf in the afternoon, and additional members and guests attended the dinner meeting in the evening. A travelogue movie on Mexico, shown through the courtesy of the Gulf Oil Corp., concluded the program.

## ALABAMA SECTION

THE RELATIONSHIP BETWEEN the engineer and the public was emphasized at the summer meeting of the Section, held in Mobile on August 22. At the afternoon technical session, which was attended by about 75, Allen Wagner, ASCE Public Relations Assistant to the Secretary, spoke on "The Engineer and Public Relations." A paper on "The Attainment of Professional Objectives by Engineers"—by Fred J. Lewis, dean of engineering at Vanderbilt University—was read by Robert H. Wallace, president of the Alabama Polytechnic Institute Student Chapter. C. Glenn Cappel, of the W. Horace Williams Co., New Orleans, concluded the session with a talk on building codes. An evening meeting—held at the Bienville pumping station of the Mobile Waterworks Co.—followed a chicken barbecue. J. B. Converse, Mobile consultant, presided.




MOMENTOUS scene in early Mobile history is depicted in etching by N. H. Holmes, ASCE life member, used for front cover of meeting program. Mr. Holmes shows Mobile becoming American territory on April 13, 1813, as Spanish officials surrender Fort Charlotte to U.S. Army. By surrender, Spain relinquished sovereignty over colonial possessions west of Florida. Etching is redrawn from old prints.

## GEORGIA

INSPECTION OF Rich's new department store building in Atlanta featured a recent meeting at which members of the American Institute of Architects were guests of the Section. Robert Lose and Herbert C. Millkey, of the architectural firm, Toombs & Creighton, conducted the group from the second basement to the roof of the new building and pointed out special features. The major problem in design was adjusting the clearances of the new building with the floor levels, the street level and existing floor levels in the main building. Installation of the air-conditioning system also involved many problems.

## ILLINOIS

A RESUME OF the past quarter of a century of Society activity was given by ASCE President E. M. Hastings at the September 16 luncheon meeting. Speaking on the subject, "What Shall the American Society of Civil Engineers Do Now?" Mr. Hastings traced the evolution of the ASCE from a purely technical society to the present-day organization of wide social interests and activities. In addition to making itself felt in national affairs, the Society is continuing and expanding its technical interests, the speaker pointed out.

## LOS ANGELES

THE PUBLIC WORKS construction outlook for the metropolitan area was reviewed in detail at the first meeting of the new season, which was held at the Alexandria Hotel on September 10. Taking part in the symposium were the following speakers: Robert Edwards, vice-president, American Pipe & Construction Co.; A. M. Rawn, chief engineer and general manager, Los Angeles County Sanitation District; Charles P. Garman, chief electrical engineer, Los Angeles Department of Water & Power; Laurance E. Goit, chief engineer of water works, Department of Water & Power; Merrill Butler, design engineer, Los Angeles Department of Public Works; Julian Hinds, chief engineer and general manager, Metropolitan Water District of Southern California; and A. D. Griffin, district engineer, California State Division of Highways. The group, numbering 170 members and guests, was entertained at dinner by Russ Stanton and his "barbershop quartet."

Prior to the regular meeting, the Juniors of the Section met for a round-table discussion of the present and future outlook for young civil engineers. Discussion ranged from the desirability of extending the engineering training period another year to the advantages of public versus private employment.

## LOUISIANA

BUILDING A COMPLETE harbor in sections and towing it across the English Channel was only one of the many tremendous projects involved in the Allied invasion of the Continent, Col. John R. Hardin, wartime deputy chief engineer for the European Theater of Operations, told the Louisiana Section at a recent meeting. Speaking on the subject, "Some Aspects of Military Engineering in the European Theater," Colonel Hardin gave a forceful account of the task engineers faced in invasion operations. A British film, showing the building, transporting and operation of the prefabricated harbor, supplemented his talk. At present Colonel Hardin is district engineer for the New Orleans district of the Army Corps of Engineers.

## METROPOLITAN

MORE THAN 60 members and guests of the Junior Branch of the Section attended a late-summer picnic held at the laboratories of the Dorr Co., in Westport, Conn. Following lunch, the group toured the laboratories, which have facilities for conducting a great variety of sanitary and hydraulic tests. Later there was a spirited ball game, with watermelon for the losers as well as the winners. New officers for the Branch, elected at the May dinner meeting, are: Brother G. Austin Barry, president; Melville H. Lyman, first vice-president; Lester J. Gitter, second vice-president; Elwyn H. King, secretary; and S. Ralph Angell, treasurer.

## PANAMA

INTERESTING FEATURES of the large-scale geodetic survey and mapping program now under way in Central America and its relationship to existing surveys in Panama were discussed at the first meeting of the 1947–1948 season, which was held in Balboa on September 8. The principal speaker was Col. F. S. Tandy, of the Army Corps of Engineers.

## SACRAMENTO

DEVELOPMENT OF private weather-forecasting facilities in the United States was described by Stephen Blewett, consulting meteorologist, at a recent luncheon meeting. Mr. Blewett stated that there is a growing number of consulting meteorologists, whose services are available to individuals and concerns requiring weather forecasts. The meteorologists are licensed by the government. At another meeting the members heard a talk on present-day China by Stewart Mitchell, Jr., son of the president of the Section. Mr. Mitchell speaks from the vantage point of eight years in China—first as a student, then as a prisoner of the Japanese, and more recently as a teacher and research worker at Yenching University. The third speaker heard at the August luncheons was H. H. Jacqueth, chief of the local allocation division of the California State Department of Finance. Mr. Jacqueth discussed several appropriation bills of the state legislature, which constitute the so-called Christmas Tree Fund. Through the courtesy of the Standard Oil Co., members of the Section saw a film on Saudi Arabia on another occasion.

## SAN FRANCISCO

SAN FRANCISCO'S TRAFFIC and transportation problems were outlined by city engineers at a recent well-attended dinner meeting. Discussion centered, in particular, on the transportation bond issue program prepared by the technical committee of the Mayor's Administrative Transportation Planning Council. Scheduled speakers were T. J. Kent, Jr., director of planning; R. L. Requa, electrical engineer for the San Francisco Municipal Railway; and H. C. Vensano, director of public works for the city and county of San Francisco. Section awards of Junior membership in the Society have been made to U. S. O'Connor, of Santa Clara University, and Donald W. Alden, of the University of California. Announcement of a similar award to Richard M. Bartle, of Stanford University, has already been made.

## SOUTH CAROLINA

THE ANNUAL MEETING of the Section—a joint session with the South Carolina Society of Engineers—was held in Greenville, S.C., on August 8 and 9, with 27 Section members in attendance. At its business meeting, the Section voted to allot $50 to each of the three Student Chapters in South Carolina to help defray the expense of sending student delegates to the ASCE Fall Meeting at Jacksonville. Speakers at the technical session were G. Heyward Mahon, of Greenville, S.C., and Prof. John D. Lane, of Clemson College. The Section also took part in the joint banquet and barbecue luncheon.

## TEXAS

ENGINEERING AND other conditions in Japan were described at the August luncheon meeting of the Fort Worth Branch by Norman F. Strachan, of the Federal Works Agency. Mr. Strachan recently returned from a trip to Japan to inspect bomb damage. Much of the meeting was devoted to discussion of the forthcoming three-day fall meeting of the Texas Section.

# NEWS BRIEFS

## Building Technology Division Is Established by National Bureau of Standards

A NEW DIVISION of Building Technology has been established in the National Bureau of Standards in recognition of the importance which this field has assumed in recent years. By no means a finished organization, the new division is made up of a number of sections and parts of sections that have come to be exclusively concerned with building technology, although formerly classified under physics, chemistry or engineering. The nucleus of the new division consists of five sections: structural engineering; fire protection; heating, ventilating and air conditioning; exterior and interior coverings; and codes and specifications.

Research will be limited to the three fields of physics, chemistry and engineering. Broader subjects, such as planning for housing developments, choice of sites, or esthetic matters, do not fall within the scope of the Bureau's activities. One of the major jobs for this year is the preparation for publication of many previously accumulated research data.

Although much of the work to be carried on will be primarily for the benefit of other governmental agencies, the results should be useful to the entire construction industry and it is intended that they shall be made available for that purpose. In addition, research problems of interest to the industry as a whole, particularly where no other research facilities are available, will be undertaken to whatever extent this is found to be possible.

Through this work the National Bureau of Standards will continue to serve as a central disinterested source of information on the facts about building materials and assemblies, with increased emphasis on the rôle that research should play in producing better and more economical construction.

## Uniform Basic Building Code Draft Presented for Industry Review

AFTER MANY MONTHS of intensive work by 70 of the nation's outstanding building-code experts, the basic building code of the Building Officials Conference of America, Inc., was presented to all industry factors at the joint annual meeting of the Conference and the Building Officials Foundation held at the Deshler-Wallick Hotel in Columbus, Ohio, September 22 to 25, according to Andrew J. Eken, of New York, chairman of the Board of Governors of the Foundation. The code will be given wide distribution among municipal and state building departments and other industry groups and factors for their study and recommendations.

The document presented in Columbus is a refinement of the tentative draft completed by the Basic Code Committee of the Conference early in March. Since that time the draft has been the subject of study by the Board of Consultants and Review. Until the Columbus meeting the code was developed solely by code authorities. The Foundation received numerous suggestions that architects, engineers, general and special trade contractors, and producers of materials and equipment be given an opportunity to review it before its final publication.

"The end result," Mr. Eken said, "will be a code that the building profession, producers, builders and all interested groups can get behind for universal adoption."

Before the code is printed in book form, public hearings will be conducted in several sections of the country, at which interested groups will be invited to participate. Mr. Eken reported that more than 600 cities have manifested interest in the Basic Code, and many of them are known to be withholding revisions of their present building laws and regulations until the finished code is made available to them for adoption.

"Since the code is being written from the functional standpoint, it will be easy under its provisions to allow for the use of all safe approved materials and equipment," Mr. Eken said. "It can potentially replace every obsolete code in the country, with resultant economies in construction and improvement in the art of building."

## Near-Peak Year in Road Building Is Predicted

ROAD MACHINES—bulldozers, cranes, trucks, and other road-building equipment—busy on the highways give evidence that the long-stymied highway construction program is gaining momentum, Charles M. Upham, M. ASCE, engineer-director of the American Road Builders' Association, stated in a recent highway conference in Washington, D.C. "Contrary to earlier gloomy predictions, 1947 bids fair to be a good year in road building," he said.

The highway program under way in North Carolina was cited by Mr. Upham as an example of increasing road-building activity. "According to the estimates of Chairman A. H. Graham, of the North Carolina Highway and Public Works Commission, some 11,186 miles of highway in North Carolina will be graded, surfaced or stabilized this year at a cost of nearly 44 million dollars. This is the largest highway expenditure ever planned by the state in a single year." Mr. Upham added that nearly three-fourths of the total amount is being spent for the improvement of county roads.

"Total highway construction expenditures over the nation will approximate $1,250,000,000 for 1947, a gain of more than $500,000,000 over the 1946 program," according to Mr. Upham. "This dollar volume in highway construction will approxi-

## *Punch a Hole in Water?*

**IT IS DONE EVERY DAY, as in this picture of an experimental quenching operation at the Research Laboratory, U.S. Steel Corp. of Delaware, Kearny, N.J. But the "hole," which is really filled with invisible water vapor, does not last long enough for the unaided eye to catch it. This picture was taken with an exposure of $^1/_{10,000}$ of a second, using a square bar of white-hot steel. Quenching—in oil, air, water, brine and many other media—is one of the most ancient of steel treatments, to give greater hardness and wear resistance.**

mate the peak highway program of the late twenties, exceeded only in 1930, when $1,500,000,000 went into road building."

"Shortages of building materials, manpower shortages, lack of trained personnel, and priorities handicapped the states in getting road programs under way," Mr. Upham continued. "In the face of such handicaps, it was impossible for states to carry on a construction program of such magnitude in the allotted time. The Federal Aid Highway Act of 1944 authorizes the largest construction program in the 31 years of federal aid for highways. With huge federal-aid appropriations available, the states will never be in a better position to meet their pressing highway needs."

"The situation is growing brighter in respect to materials and equipment," he added. "Modernization of our highway system is long overdue. With stabilization of construction costs, road building will emerge into a period of unparalleled activity."

## Western Highway Construction Bids Are Held in Line with 1946 Prices

SOME WESTERN STATES are successfully conducting large highway construction programs, and the Public Roads Administration's policy of holding contract awards to bids in line with 1946 prices has not materially slowed down Western highway construction. This fact was brought out in discussions at the meeting of the Joint Cooperative Committee of the American Association of State Highway Officials and The Associated General Contractors of America, held recently in conjunction with the annual meeting of the Western Association of State Highway Officials in Missoula, Mont.

California and Texas reported substantial programs under way, and a sufficient amount of competitive bidding. In general, it was reported that southwestern states were receiving more competitive bids. Some states reported that more bids were forthcoming on the larger projects, and some reported contractors' bids were close to estimates, some below estimates, others above. One state reported that recent bids were slightly lower than those of 1946.

The price situation in general was spotty —higher in some states than in others. Contractors are experiencing rising costs of equipment, parts and labor. Deliveries of equipment were reported tight in some states, and easing up in others. Some shortages of labor were noted, and difficulty in securing sufficient labor for rural projects was reported by most contractors. Highway officials reported in many instances substantial differences in prices in different sections of the same state, a condition that must be taken into consideration in preparing estimates.

Reduction of construction costs of bridges was discussed. Some advocated that concrete products manufacturers turn out uniform units which could be trucked to a job for use in small bridges. All agreed that insistance by both contractors and awarding authorities on firm prices and bona fide delivery dates would help stabilize prices.

## Limiting of Truck Loadings on Highways Is Recommended

TEMPORARY STABILIZATION of truck loadings at 18,000 lb per axle, with a 10 percent tolerance, until a sufficient network of highways has been raised to a standard that would justify increasing the load, was proposed by Charles M. Upham, M. ASCE, engineer-director of the American Road Builders' Association at the Canadian Good Roads Association's annual convention at St. Andrews-by-the-Sea, New Brunswick.

Mr. Upham, who is chairman of the Executive Committee of the Highway Division, ASCE, suggested that there should be some compromise between building vehicles to suit the highway and highways to suit the vehicle. In this way, he said, definite limits could be provided within which the engineer could utilize new developments in highway engineering to provide roads that will carry a larger percentage of loads.

"At this time," said Mr. Upham, "there can be no final decision concerning ultimate sizes and weights. There should, however, be periods of stabilization during which roadways are constructed for greater loads. The problem is one of economic balance."

"Highways must be provided for a greater volume of traffic as soon as possible. Greater lane-widths and more bearing capacity are needed. Future sizes and weights of motor vehicles will depend on highway design, and particularly on the size of the sustained construction program."

Mr. Upham drew a parallel between railroad needs after the Civil War and the needs of the trucking industry today. He also pointed out that while not more than 3.8 percent of trucks in the United States are over 5-ton capacity we must remember that highways should be of maximum service to our national economy and that the demands of heavy truckers for a higher axle-load must be taken into account. Against fixing limits for all time, Mr. Upham states that had we set such limits after World War I to accommodate the vehicles of that day we would have lost much of the economic advantages we have since enjoyed.

Predicting that highway building in the United States would increase until 1949, Mr. Upham estimated the amount of new road construction under contract would exceed two billion dollars. From that time on the highway program should be from two to three billion dollars annually if adequate transportation is to be maintained.

## Resurgence in Building Activity Is Nationwide

A DEFINITE RESURGENCE in building is under way, according to a survey by *Business Week*, and both "starts" and completions are notching upward. "The trend was first indicated," the publication reports, "when July figures, just released, bore out on a national scale what contractors had been experiencing locally. Footings were poured for the foundations of 80,000 new homes in July and the last dab of paint was brushed on 65,700 completed homes. Those figures are not only the best for any month in 1947; they far surpass those of 1946."

The most conclusive proof of the resurgence, the survey reveals, is that traditionally there are fewer starts in the summertime than in the spring. Probably the most important contributing factor of all—and hardest to discern—is public psychology. "It may well be," the magazine states, "that the American public has decided not to wait any longer for prices to come down and is bulling the market.

"Construction of more residences for rent is another reason. Multiple-family dwellings of various kinds—apartment houses flats and duplexes—are being built in greater numbers. Higher priced homes—those above $20,000 or $25,000—are under construction in plenty of places for the first time in ages. And some house renters, who feel that they can't talk the landlord out of an increase, have decided to save their breath by becoming homeowners."

Other possible reasons for the upsurge are given as the Federal Housing Administration's emphasis on rentals, increased supplies of building materials and improved building codes.

"The Commerce Department now expects that total construction of permanent private houses this year will run close to 800,000. This is lower than the million predicted at the beginning of the year, when government stimulus still was assumed, but it is better by far than was feared in the late winter of 1946–1947, when starts were low."

## 1947 Brick Production Shows 10 Percent Rise Above 1946

PRODUCTION OF BRICK during the first seven months of 1947 was 10 percent greater than in the same period of 1946, Roy A. Shipley, president of the Structural Clay Products Institute, stated recently.

"Manufacturers produced 2,700,000,000 brick during the seven-month period," Mr. Shipley said. "The industry's output during July 1947 totaled 444,000,000 brick, according to preliminary estimates, a gain of 7 percent over June, and a decline of 10 percent compared with July of last year. The output of structural clay tile during July is estimated at 116,000 tons, 9 percent more than in June of this year and 2 percent less than in July 1946. Inventories in the hands of manufacturers and dealers have been rising during recent months and most orders for truck shipment can be filled promptly."

# Third International Congress on Large Dams to Be Held Next Year in Stockholm

**Wesley R. Nelson**
**Acting Commissioner of the Bureau of Reclamation, Washington, D.C.**

A DECADE AGO some bold engineer hazarded the opinion that the "mid-thirties" would go down in history as the period in which monumental dam building reached its peak. With Hoover and Grand Coulee dams under construction, the possibility of finding other sites and economic factors which would allow dams of comparable size to be built seemed remote.

How unimaginative in the light of events! John L. Savage, M. ASCE, and vice-president of the International Commission on Large Dams, writing recently concerning preliminary work for the Third Congress of Large Dams scheduled for Stockholm next year, listed the following dam projects for construction in the next decade:

Super Dixence, Switzerland, and Kofi Dam, Nepal, India, 850 ft in height; Yangtze Gorge and Ma Chi Dams, China, 800 ft; Dhi Angarh and Keshau Dams, India, 750 ft; Larji, India, and Ross Dam, U.S.A., 700 ft; and a number of others 600 ft or less, all of which a few years ago would have been thought beyond the realm of possibility.

It is clear that if dams such as these are to be economically and soundly designed and built, nothing less than a mobilization of the world's talent in dam engineering will serve.

The Third International Congress on Large Dams to be held at Stockholm next summer appears to fill the need of the moment. At that meeting, engineers from all over the world will discuss the following questions:

1. Uplift on dams and resulting stresses
2. Instrumentation and stress measurements in dams
3. Control of seepage through dams
4. Behavior of structures built of special cement

As is true of many congresses, the informal discussions of engineers and construction men attending the Stockholm Congress may lead to more results and crystallization of opinion concerning the art of dam design than those formulated at the official meetings. Members of the Society or others interested in taking part in the Congress or in submitting papers can obtain preliminary information by writing to Michael W. Straus, chairman, National Committee on Large Dams of the World Power Conference, Commissioner of Bureau of Reclamation, Washington 25, D.C., whose committee has been carrying on the initial preliminary organizational work necessitated by the interim of the war.

# Institute of Numerical Analysis Is Established

PLANS HAVE been completed for the establishment of one of the newest units of the National Bureau of Standards—the Institute of Numerical Analysis—at the University of California at Los Angeles, according to an announcement by Dr. Edward U. Condon, director of the Bureau.

One of the giant high-speed electronic computing machines, now under development by the Bureau of Standards, will be installed at the institute when completed. These computers will solve problems that are now out of the reach of scientists. Design specifications call for high memory capacity and automatically sequenced mathematical operations from start to finish at speeds attainable only with electronic equipment.

The institute has two primary functions. The first is research in applied mathematics aimed at developing methods of analysis which will extend the use of the high-speed electronic computers. The second is to act as a service group for Western industries, research institutions, and government agencies. The service function will include not only the use of the machines for problem solving but also assistance in the formulation of problems in applied mathematics of the more complex and novel types. Service operations are to be initiated immediately, using the latest types of commercially available computing equipment.

# Large Construction Projects Announced by Bureau of Reclamation

UNDER THE HEADING of "Bid Calls Expected This Month," the Bureau of Reclamation's *Advance Construction Bulletin* for September 2, lists several large construction projects in Western states. According to the *Bulletin*, these announcements are for information only and all information is subject to revision. The data will, however, serve as a guide to the nature, size and location of proposed reclamation projects.

## TUNNEL EXCAVATION

### Hungry Horse Project, Montana

**Location:** 25 miles northeast of Kalispell, Mont.
**Work:** Excavation for diversion tunnel, 1,050 ft long, 36-ft-dia horseshoe: 50,000 cu yd plus excavation of open cuts at portals.

## SWITCHYARD EXCAVATION, FOOTING, AND SURFACING

### Keswick Dam, Central Valley Project

**Location:** Redding, Calif.
**Work:** Construction of 115-kv and 230-kv switchyards, and left abutment parking area.

| | |
|---|---|
| Excavation | 55,000 cu yd |
| Compacted fill | 44,000 cu yd |
| Installing pipe, valves, miscellaneous metal work | 134,000 lb |
| Furnishing and placing reinforcement steel | 230,000 lb |
| Electrical conduit | 86,000 ft |

**Time Allowed for Completion:** 270 days.

## STREET, SEWERAGE, AND WATER DISTRIBUTION SYSTEMS

### Canyon Ferry Government Camp, Missouri Basin Project, Montana

**Location:** Vicinity of Helena, Mont.
**Work:** Construction of streets, sidewalks, and gutters; and drainage, sewerage, and water distribution systems.
**Time Allowed for Completion:** 300 days.

## STEEL PENSTOCKS

### Davis Dam Project, Arizona-Nevada

**Location:** Davis Dam and Powerplant, 30 miles west of Kingman, Ariz.
**Work:** Construction of five 22-ft-dia, welded, plate steel penstocks.
Steel plate required 3,000,000 lb
**Time Allowed for Completion:** 500 days.

## CABLEWAY AND GAGING STATION

### Davis Dam Project, Arizona-Nevada

**Location:** Davis Dam, Colorado River, 30 miles west of Kingman, Ariz.
**Work:** Erection and installation of cableway (approximate length: 1,000 ft), and gaging station.
**Time Allowed for Completion:** 150 days.

## SPILLWAY GATES, HOISTS, AND BRIDGE

### W. C. Austin Project, Oklahoma

**Location:** Altus Dam, near Altus, Okla.
**Work:** Installation of spillway gates, hoists and bridge on Altus Dam.

| | |
|---|---|
| Installing pipe handrail | 11,000 lb |
| Installing radial gates | 154,000 lb |
| Installing hoists | 37,000 lb |
| Furnishing and placing reinforcement bars | 6,300 lb |
| Erecting structural steel in bridge | 36,000 lb |

**Time Allowed for Completion:** 180 days.

## PUMP HOUSE

### Boulder Canyon Project, Nevada

**Location:** Vicinity of Boulder City, Nev.
**Work:** Construction of 22×55-ft reinforced concrete pump house.

| | |
|---|---|
| Excavation | 1,350 cu yd |
| Reinforcement steel | 39,000 lb |
| Concrete | 235 cu yd |

**Time Allowed for Completion:** 180 days

## DRAIN INLETS AND FARM BRIDGES

### Tucumcari Project, New Mexico

**Location:** Vicinity of Tucumcari, N. Mex.
**Work:** Construction of drain inlets, farm bridges and operating bridges on Conchas Canal, Stations 22+00 to 3,063+33.8.

| | |
|---|---|
| Excavation | 4,170 cu yd |
| Concrete in structures | 360 cu yd |
| Reinforcement steel | 29,700 lb |
| Timber | 104 Mb. m. |
| Backfill | 3,100 cu yd |

**Time Allowed for Completion:** 150 days.

## Complaints Stress Needless Opening of Drawbridges

NEEDLESS OPENING of bridge draw spans to permit the passage of small fishing boats has caused much delay to vehicular traffic in New Jersey and has brought many complaints, according to New Jersey's State Highway Commissioner, Spencer Miller, Jr. One of the recent complainants, Mayor Paul C. Burgess of Brigantine, N.J., declared that the Atlantic City–Brigantine Bridge "is being raised many times during the day to accommodate small fishing boats which ordinarily could pass under the bridge except for the fishing poles." These, the Mayor maintained, "should be constructed so that they can be lowered instead of holding automobile traffic by opening the drawbridge."

The Mayor's letter has been referred to the district commander of the Coast Guard, the policing agency for enforcing War Department regulations. According to such regulations, all appurtenances unessential to navigation must be removed or lowered when a boat is passing through channels of drawbridges on the Inland Waterway.

## Large Increase in New Home Construction Shown by Survey

CONSTRUCTION of new homes in 115 key metropolitan areas of the United States last year was more than 50 percent greater than in 1939, the annual Investors Syndicate survey of housing construction has revealed. The increase over 1945, when civilian home building got under way late in the year, was 410 percent. Total new housing units built in these key communities in 1946 were approximately 412,455 against 101,511 in 1945. At the same time, the average cost per unit increased by 45 percent, from about $4,725 in 1939 to $6,870 in 1946.

There has also been a sharp swing away from apartments to one and two-family homes, the Investors Syndicate survey shows. While in 1946 there were more than twice as many homes built as in 1939, there were 30 percent fewer apartments. Although the demand for apartments is great, builders cannot find it profitable to erect multiple-unit housing and hence have concentrated on single-occupancy homes. It is expected that the small volume of apartments built during the war and under rent ceilings will affect the housing situation for many years to come.

## Fort Lauderdale Plans Large Recreation Project

CONSTRUCTION is about to begin on Fort Lauderdale's $4,000,000 municipal recreation project which will cover a 27-acre ocean-front site formerly occupied by the U.S. Coast Guard. The property includes a half mile of ocean bathing beach and almost the same amount of frontage on the Intracoastal Waterway to the west. Plans include a number of buildings, largest of which will be an auditorium-theater seating 2,000 people. Utilities required for the project include streets, water, gas and electricity. Bulkheading will provide dockage along the entire Intracoastal Waterway frontage.

The city of Fort Lauderdale will own the property, acquiring it from the U.S. Treasury Department for $600,000. Management of the several facilities by private operators will be through lease arrangement with the city. The Caldwell-Scott Construction Co. of New York and Fort Lauderdale has been named supervising general contractor for the project.

## Senior Structural Engineers Needed by State of California

SALARIES RANGING from $5,772 to $7,000 are offered by the California State Division of Architecture for senior structural engineers, to do, under direction, "the more difficult types of technical and supervisory structural engineering work involved in the design and in the examination in the field of major structures." A continuous civil service examination is being given to qualified applicants by the California State Personnel Board. Applications must be made on official forms obtainable in person or by written request from the following offices of the Board: 108 State Building, San Francisco; 1015 L Street, Sacramento; 104 State Building, Los Angeles.

## American Welding Society Elects Executive Secretary

TO FILL its newly created position of executive secretary, the American Welding Society has chosen Joseph Gordon Magrath, who took office on September 2. Engaged in welded product design since 1917, Mr. Magrath has been active in the work of the New York section of the American Welding Society and served for several years as chairman of publicity and programs.

Continuing in their present posts are: M. M. Kelly, secretary; W. Spraragen, editor of the *Welding Journal* and director of Welding Research Council; and S. A. Greenberg, Jun. ASCE, technical secretary.

## Meetings and Conferences

**American Institute of Mining and Metallurgical Engineers.** Current and future developments in the mineral industry are scheduled for discussion at the first postwar regional meeting of the American Institute of Mining and Metallurgical Engineers, convening at the Shirley-Savoy Hotel in Denver, Colo., September 28–October 3.

**American Society of Tool Engineers.** More efficient tools as the means to a sounder economy will be the theme of the 15th semiannual meeting of the American Society of Tool Engineers, to be held at the Statler Hotel in Boston, Mass., October 30–November 1. Inquiries should be addressed to Harry E. Conrad, executive secretary, American Society of Tool Engineers, 1666 Penobscot Building, Detroit 26, Mich.

**American Society for Metals.** With Chicago as its 1947 meeting place, the 29th Annual National Metal Congress and Exposition will open for its first seven-day session on October 18. Approximately 375 organizations will display and operate metal working equipment and products at the International Amphitheatre. In addition, there will be technical sessions of the American Society for Metals, the American Welding Society, and the Iron and Steel and Institute of Metals Divisions of the American Institute of Mining and Metallurgical Engineers at the Palmer House.

**American Society for Testing Materials.** The Statler Hotel in Detroit, Mich., will be convention headquarters for a four-day meeting of the American Society for Testing Materials, to be held October 6–9.

**American Transit Association.** A three-day program of division sessions has been arranged for the annual meeting of the American Transit Association, which will be held in the Hotel Traymore, Atlantic City, N.J., October 8–10.

**Institute of Traffic Engineers.** Problems of traffic control are being discussed at the 18th annual meeting of the Institute of Traffic Engineers, scheduled for the Hotel Fort Shelby, Detroit, October 1–4.

**International Lighting Exposition and Conference.** Planning today for tomorrow's lighting will be the theme of the second International Lighting Exposition, to be held at the Stevens Hotel in Chicago, November 3–7. The five-day program is sponsored by the industrial and commercial lighting equipment section of the National Electrical Manufacturers Association.

**National Conference on Industrial Hydraulics.** The third annual meeting of the National Conference on Industrial Hydraulics (formerly the Hydraulic Machinery Conference) will be held at the Hotel Continental in Chicago on October 16 and 17. Prominent on the list of speakers are Boris A. Bakhmeteff, Hon. M. ASCE, and Hunter Rouse, M. ASCE. Sponsoring groups are the Armour Research Foundation and the graduate school of the Illinois Institute of Technology, in cooperation with the Western Society of Engineers and the Chicago sections of the ASCE, ASME and SAE.

**National Council of State Boards of Engineering Examiners.** A wide range of problems arising in the professional qualification of engineers will be covered at the 26th Annual Meeting of the National Council of State Boards of Engineering Examiners, to be held at the Hotel Pennsylvania in New York City, October 27–29.

**National Safety Congress and Exposition.** A five-day National Safety Congress and Exposition will be held under the auspices of the National Safety Council, at the Stevens and Sherman hotels, Chicago, October 6–10.

**The Producers' Council.** Reports on current trends in building activity, estimates of future construction volume and talks on the housing situation were featured at the third annual meeting of the Producers' Council, national organization of building products manufacturers. The meeting took place at the Hotel Commodore in New York City, October 1–3.

R. Robinson Rowe, M. ASCE

AT THE OCTOBER meeting of the Engineers Club, half the members wanted to talk about raising dues and half were talking louder about diophantine bikes. Obviously the loud-mouthed surveyors had to be satisfied before any business could be transacted, so Professor Neare, the opportunist, claimed the floor and yielded it to Guest Professor Stoop Nagle.

"Several have asked me, Noah, whether the township line was level enuf for precise measurement with a bicycle tire. We old-timers know how contract surveys were made in the '60s, with compass and one-rod wagon wheel. A cowbell was lashed to a spoke so that it tolled each revolution and the surveyor took it easy counting bells, four to the chain, from one monument to the position of the next. Sy Klurr was smart in following a similar procedure in order to verify government measure. The question was what monument he reached."

"The NE corner of Section 36," said Joe Kerr. "The combination of chain and sprocket positions will occur when the equations $L = 13N = 61C + 13 = 29S + 23$ can be solved in integers, where $N$ is the number of revolutions of the wheel, $L$ the advance of links of chain, $C$ the complete turns of the chain and $S$ the complete turns of the front sprocket. This occurs when $N = 62$, and since 10 revolutions make a chain, Sy pedaled 6.2 chains and coasted 73.8 chains to the monument."

"That wouldn't verify the distance," objected Ken Bridgewater, "and besides diophantine bikes have no coaster brakes. The distance must be even miles, giving an equation $L = 10{,}400\,M$ to be satisfied, and the least $M$ is 889 miles to the NE corner of Section 36, T 149 N, R 1 W, S.K.B.M."

"Far too far for a pedaling job," contended Cal Klater. "Joe and Ken, being Easterners, don't know that monuments are set every half mile, so that the equations should be: $L = 5{,}200H = 61C + 13 = 29S + 23$, for which the general solution is $H = 9 + 1{,}769k$, where $k$ is any integer. When $k = 1$ we have Ken's solution, but $k = 0$ makes the distance 9 half miles to the E. 1/4 corner of Section 12."

"That's the spot, Cal. Nice hunting. I wish we had time to show the reduction of the equations to your general solution, but Noah is calling time."

"Just barely time for a new assignment, Stoop, and thanks for your problem that gave the Westerners a break. A methodical chap named Lon Moore mowed his quadrilateral lawn perimetrically, cutting swathes of equal width from each side in turn. The sides of the lawn in clockwise order from the widest angle were 50, 120, 104 and 78 ft, respectively. After 21 complete tours, the first two sides had been reduced to 6 and 43 ft. How wide a swathe did Lon cut and how nearly was he done?

[*There were lots of Cal Klaters: Richard Jenney, Oldcutantry (Warner Harwood), Howard B. Stanley, F. W. Robison, A. Nuther Nutt (still anon), Homer W. Woodbury, W. J. Ryan, Bill Durr (Coleman W. Jenkins), and Anne Othernut (J. Charles Rathbun). There were even more Joe Kerrs. The Guest Professor was John C. Nagle. Just missing an early deadline last month were solutions of Amby Dexter's card problem from Jenney and O'Kay (Otto H. S. Koch).*]

## Virginia's Primary System Gets $20,000,000 Allocation

TENTATIVE ALLOTMENTS for Virginia's primary highway system total $20,000,000 for the fiscal year 1948–1949, an amount nearly $2,500,000 more than was allocated to it during the current year. However, it has "less than ten cents for every dollar necessary to meet immediate needs," according to the State Highway Commission.

Funds for primary road construction go for the improvement and reconstruction of some 9,000 miles of highway. The 38,000-mile secondary system, also under state administration, is financed from different allocations.

Under Virginia's method of allocating primary road funds, each of the eight construction districts gets a sum determined by a factorial method of distribution. Each district's sum is then allocated to various projects within the district. Most of the work will be let to contract on the basis of competitive bids.

## Small Home Building Is Topic of Time and Motion Study

INFORMATION AS TO HOW the small contractor and builder can reduce construction costs is the goal of an extensive time-and-motion study of site fabrication of small homes recently started by the Small Homes Council of the University of Illinois. The research project, designed to advance the technology of small house construction and to increase the contractor's efficiency, is being carried on in cooperation with the U.S. Department of Commerce.

Factors to be studied are organization of the construction job, flow of materials, handling of materials at the site, and construction techniques. The experimenters will build six houses of the same plan and design, adaptations of the industry-engineered house developed as a low-cost house by the Producers' Council and the National Retail Lumber Dealers Association. The design utilizes materials to the utmost in a conventional-type construction through better engineering of all phases of construction.

This is the first time that a university has conducted a time-and-motion study on a house during construction. Large building operators frequently have conducted such studies, enabling them to make substantial savings. The results of such studies, however, are not available to the small builder.

A CYPRESS LOG dug from approximately 20 ft underground in the Mississippi Delta had lain there, according to scientists, for over 10,000 years and was still in an excellent state of preservation.

LAKE SUPERIOR, about 3,200 miles in area, is the largest body of fresh water in the world.

WIRE ROPE 1/16 in. in thickness, used for airplane controls, will hold a load of 450 lb.

AN AVERAGE CUBIC MILE of sea water contains more than 128,284,000 tons of sodium chloride or common salt.

THE SUN is an immense atomic furnace consuming some 4,000,000 tons of its own mass each second.

A 75-WATT infra-red lamp, the rays of which are powerful enough to light a cigarette held a half-inch away, has been developed for special heating and drying processes in industry.

AFTER THE TOWN'S windowpanes repeatedly fell out of their frames, mystified residents of Broadwoodwidges, England, began keeping watch and found that hungry birds were eating the ersatz putty.

CLOCKS WITH tiny crystal hearts that beat 100,000 times a second throb their cyles without varying as much as a second a year in the Bell Telephone Laboratories.

RADIO BROADCASTING was born on November 2, 1920, when the Presidential election returns were broadcast from the tiny radio station KDKA at the Westinghouse plant in East Pittsburgh, Pa.

A BOY in his father's spectacle-making shop around 1610—two lenses and a tube—the result, the accidental discovery of the first compound microscope. The boy—Zacharias Jansen.

SODIUM FLUORIDE makes molten steel more fluid, eliminates gas bubbles; anhydrous HF is a key catalyst in production of aviation gasoline.

PUBLIC WATER SUPPLIES in the United States date from about 1652 at Boston, Mass.

THE FOCAL POINT of an earthquake is normally between one and 31 miles beneath the surface.

EMPLOYMENT SURVEY for 1947 conducted by Northwestern University for graduates shows demand for scientists and engineers at 58 percent of total needs in all fields.

AT KHARKOV, Russia, is a perfect timepiece precise to 1/10,000 of a second. Soviet scientists have observed small irregularities in the earth's rotation by use of this clock.

THERMOPOLIS Hot Springs in Wyoming is an outstanding geological phenomenon. It is the largest known mineral hot spring. It flows 18 million gal of water at a temperature of 185 deg F every 24 hours.

NEVADA plans to install a state-owned generator at Hoover Dam.

## Turbines Returned to Shasta After War Duty at Coulee Dam

TRANSFER of two 103,000-hp hydraulic turbines from a temporary wartime installation at Grand Coulee power plant to their final position at Shasta power plant involved unusual engineering problems according to Herbert H. Sloane, engineer with the Bureau of Reclamation, Denver, whose paper describing the work was presented at the fall meeting of The American Society of Mechanical Engineers.

The two 75,000-kw turbines were originally designed for the Shasta power plant on the Sacramento River but the critical need for power in the Pacific Northwest to serve expanding shipyards and other war industries led Reclamation Bureau engineers to propose temporary installation of the units at Grand Coulee—a proposal which received the prompt approval of the War Production Board.

The work of preparing the Grand Coulee turbine pits for the temporary units required cutting openings about 20 ft high and 30 ft long in double walls of 4-ft thickness. Excavation of concrete work was begun in May 1942 and completed the following month.

The two Shasta generating units performed well in their temporary location, Mr. Sloane stated. Together they supplied over three billion kilowatt-hours to the war industries of the Northwest. Rated at 75,000 kw, they produced 84,000 kw continuously and could meet a peak demand of 92,500 kw. No major repairs were needed.

The spiral casing on the turbines was "one of the first, and undoubtedly the largest welded plate steel spiral casing to be built in this country," according to J. F. Roberts, manager of the hydraulic department of the Allis-Chalmers Manufacturing Co., which designed and built the units.

The biggest job in dismantling of the turbines was the removal of the temporary concrete supporting the generator and embedding the turbine casings. Concrete to be removed amounted to about 6,500 cu yd and most of it was broken out in large blocks some weighing as much as 87 tons. Concrete around the turbine casing and draft-tube liner, however, had to be removed by hand-operated chipping guns, a slow and difficult job. Reassembly of these units in their final position in the Shasta power plant is now nearing completion.

## Inter-American Sanitary Conference Is Postponed

THE THIRD Inter-American Sanitary Engineering Conference, which was to have been held in Santiago, Chile, November 20–27, has been postponed until April 1948. Definite dates will be announced later.

As noted in the September issue of CIVIL ENGINEERING, collaborating groups for the conference are the Inter-American Association of Sanitary Engineering and the Institute of Engineers of Chile.

## New Publications

**Engineers' Council for Professional Development.** To commemorate the 15th anniversary of its founding, the Engineers' Council for Professional Development has issued a booklet entitled "As an Audit of Accomplishments, 1932–1947." Major achievements of ECPD, an organization which has the prime objective of raising the status of the engineer, are listed and plans for future action outlined in this anniversary brochure.

**Water Wells.** A 200-page *Water Well Handbook*, containing charts, tables and other data relating to the drilling, testing and operation of water wells, is being published by the Missouri Water Well Drillers Association. The handbook, which will be ready for distribution soon, will be sold at cost (approximately $1.50 per copy).

**Traffic Studies.** A new method of studying the behavior of free-moving traffic—expected to be of value in plotting improved traffic-control measures—has been developed by the Bureau of Highway Traffic at Yale University and is now available as Technical Report No. 1 of the Yale Bureau. The study, which is concerned with time-space relationships at urban intersections, was initiated in 1944 through a grant from the Eno Foundation for Highway Traffic Control. Bruce D. Greenshields, Assoc. M. ASCE, is senior author of the report, and Donald Shapiro and Elroy S. Ericksen are junior authors.

**Steel Products.** Four new sections in the Steel Products Manual, which is being issued in installments by the American Iron and Steel Institute, are now available. These are Section 10, dealing with "Hot Rolled Alloy Steels"; Section 11, entitled "Hardenability of Alloy Steels"; Section 16, on "Carbon Steel Wire"; and Section 26, covering "Flat Rolled Electrical Steel." Copies may be obtained from the Iron and Steel Institute, 350 Fifth Avenue, New York, N.Y., at a cost of 25 cents each.

**Sewage Works.** To acquaint sewage works operators with a lecture-laboratory course in sewage treatment and disposal—given at St. Joseph's College, Philadelphia, in 1945 as part of the ESMWT program—the Pennsylvania Sewage Works Association has published the proceedings of the course. The lectures are given verbatim in one volume. Another volume, entitled "The Laboratory Guide," sets forth the technique of various tests involved in the operation of sewage plants. Cost of the publications, sold only as a set, is $3. Apply to Bernard S. Bush, secretary of the Association, Kirby Health Center, Wilkes-Barre, Pa.

**Water Resources.** A mimeographed study of the water resources of Tuscarawas County, Ohio, has been issued as Bulletin No. 6 of the Ohio Water Resources Board. Like others in the series of groundwater studies, being prepared by the Board in cooperation with the U.S. Geological Survey, the report may be purchased from the Ohio Water Resources Board, Columbus, Ohio, at a cost of $1 a copy.

**Safety Engineering.** Elimination of accident hazards in the home and on the highway is the aim of *Watch*, quarterly publication of the American Mutual Liability Insurance Co. Inquiries should be addressed to the company at 142 Berkeley Street, Boston 16, Mass.

**Municipal Improvement.** A proposed schedule of municipal improvements for New Haven, Conn., for the six-year period, 1948–1953—prepared by the Capital Budget Programming Committee—is now available in mimeographed form. Charles E. Downe, Jun. ASCE, served as city planning engineer on the committee.

**Highway Recommendations.** First in a new Road Note Series, being issued by the British Department of Industrial and Scientific Research to replace its Wartime Road Notes, is "Recommendations for Tar Surface Dressings." The price by post is 4d, and application should be made to H.M.S.O., Kingsway, London W.C. 2, England.

**Engineers Salaries.** Schedules of minimum salaries and fees—prepared by the Iowa Engineering Society as a guide to employers in determining fair minimum salaries for engineering services—may be obtained in phamphlet form from the Iowa Engineering Society, 418 Hubbell Building, Des Moines 9, Iowa. C. M. Stanley, M. ASCE, headed the Salaries and Fees Committee that drew up the recommendations.

**Mathematical Computations.** To disseminate information on research and development in the field of high-speed automatic calculating machinery, the quarterly journal *Mathematical Tables and Other Aids to Computation* is establishing a new feature section on "Automatic Computing Machines." Contributions (including bibliography, technical developments, discussion, and news) are invited and should be addressed to Dr. W. E. Cannon, head of the Mathematics Group, Machine Development Laboratory, National Bureau of Standards, Washington, D.C.

**Highway Safety.** Action taken at the President's Highway Safety Conference, held in Washington in June, is summarized in a recent government publication, "Immediate Goal." Inquiries should be addressed to the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

**Federal Research.** Findings on federal research facilities and recommendations for more effective use of national scientific resources are outlined in the first volume of a projected series called *Science and Public Policy*. The present volume, subtitled "A Program for the Nation," is for sale by the Superintendent of Documents, Government Printing Office, Washington 25, D.C., at a cost of 20 cents.

**Building Materials.** To aid local lumber and timber industries in their long-range planning for production and marketing, the Bureau of Business Research of the University of Washington has initiated a comprehensive research project in building materials. Results of the study, which is under the supervision of N. H. Engle, director of the Bureau of Business Research, will be reported from time to time in *Pacific Northwest Industry*, monthly publication of the Bureau.

# NEW IN Education

UNIVERSITY COLLEGE, LONDON, has enlarged its photoelasticity laboratories and equipped them with modern apparatus in preparation for its fall term of laboratory and research work. Among the research problems awaiting investigation are some on the properties and treatment of plastics, some for improving the technique of stress-exploration, and many on three-dimensional stress distribution in parts of structures and machines. The college's curriculum in photoelasticity includes a full course of lectures and laboratory training in the elementary theory of elasticity and the theory and practice of photoelasticity. There is also a shorter course intended for senior and postgraduate engineering students, or for physicists or mathematics students doing work in this field.

HIGH SCHOOL COURSES in the principles of good driving were recommended by 78 percent of those contacted in a survey of public opinion made by Opinion Research Corp., under the sponsorship of the National Safety Council cooperating with the National Committee for Traffic Safety. To encourage the adoption of programs of driver education as a regular part of every high school curriculum, the pamphlet, "Automobile Driver Education for High School Students," has been issued jointly by the U.S. Junior Chamber of Commerce (Baird Office Building, Gainesville, Fla.) and the National Conservation Bureau. Either of these organizations will furnish a copy of the pamphlet on request.

MORE THAN 11,000 welding patents now in the Davis Welding Library at Ohio State University were newly classified this summer to make it easier for industries, students and research workers to obtain information on patents granted in their specific lines. In charge of the reclassification project was Dr. W. H. Simon of the University of Toronto. Cost of the work was paid from the A. F. Davis Welding Engineering Scholarship and Library Fund set up by Mr. Davis, vice-president of the Lincoln Electric Co., Cleveland, and an alumnus of Ohio State University, when he established the welding library a number of years ago. Previously the patents were grouped according to the classes and subclasses of the U.S. Patent Office, set up when welding was in its infancy.

TWICE AS MANY applications are being received at the Cooper Union School of Engineering for evening courses in mechanical and electrical engineering as for evening courses in civil and chemical engineering, according to Walter S. Watson, Admissions Officer. Of 624 qualified applications for Freshmen places in the evening courses, 35.4 percent requested mechanical engineering; 32.8 percent, electrical engineering; and only 16.4 percent wanted civil engineering and 15.4 percent chemical engineering.

AN EXAMINATION SUITABLE for the evaluation of the work of students of engineering who have completed their sanitary option is now available through the Merit System Unit of the American Public Health Association. This examination is of the objective, multiple-choice type and covers such fields as water supply, sewage disposal, elements of chemistry and bacteriology, communicable disease, and sanitary engineering design. At the University of Kansas where it was used this spring, a high correlation was obtained between students' scores on this test and independent faculty evaluation. Additional information with regard to its use may be obtained by writing to Dr. Lillian D. Long, American Public Health Association, 1790 Broadway, New York 19, N.Y.

THE EXPERIMENTAL TOWING TANK Laboratory of Stevens Institute of Technology, Castle Point, Hoboken, N.J., has awarded its fourth fellowship to George R. Holladay of Rapidan, Va. Fellowships are limited to five at a time and since work is on an individual basis, applications and appointments may be made at any time during the year. Fellows work as regular members of the staff on actual research programs during the operating hours of the tank, thus gaining experience in the broader principles of hydrodynamic research on which the tank is engaged.

## Radiant and Convector-Type Heating to Be Compared

AN OPPORTUNITY FOR STUDYING differences between radiant and convector heating systems in the same multi-story structure will be provided by the eight-story student apartment under construction on the campus of Georgia School of Technology. One wing will be heated by wrought-iron pipe coils and the other by conventional-type convectors. The building, of reinforced concrete construction in the form of the letter "H," contains about 63,000 sq ft of floor space. Radiant heating pipe, fabricated in sinuous coils, is embedded in the concrete structural floor of each story, each room having a separate coil equipped with a balancing valve. Two convertors, one for each system, supply hot water from the school's central steam supply lines. The convertor for the radiant heating system is set at 120 to 140 deg F, and that for the convector system at 180 to 200 deg F. Both convertors are 5,000 gal per hour at 25-lb pressure. Heat losses for the entire building are calculated at 1,500,000 Btu, with a minimum outdoor design temperature of +10 deg F. Building, designed by Stevens & Wilkinson, Atlanta, is being erected by J. A. Jones Construction Co.

## Lincoln Arc Welding Offers Awards for Undergraduates

A SERIES of $6,750 Annual Engineering Undergraduate Award and Scholarship Programs is being sponsored by The James F. Lincoln Arc Welding Foundation to place the possibilities of arc welding in design and maintenance before the undergraduate engineering student. The program contains two interdependent plans—the Award Plan and the Scholarship Plan.

Under the Award Plan engineering students of various schools and colleges will submit papers on arc welded design in parts of machines, complete machines, trusses, girders, and structural parts and on the use of welding in the maintenance of machines and structures. It is not necessary that the machine, structure, or part be actually built, but the design or method of construction must be described in the paper. The awards offered for papers are as follows:

| NUMBER OF AWARDS | AMOUNT OF EACH AWARD | TOTAL AMOUNT OF AWARDS |
|---|---|---|
| 1 | $1,000 | $1,000 |
| 1 | 500 | 500 |
| 1 | 250 | 250 |
| 4 | 150 | 600 |
| 8 | 100 | 800 |
| 12 | 50 | 600 |
| 50 | 25 | 1,250 |
| 77 | | $5,000 |

Under the Scholarship Plan the institutions in which the three top awards are made to students will receive amounts of money equal, respectively, to the student awards. These amounts are to be used for scholarships in the departments in which the award students are registered. Thus the department of the institution in which the first award winner is registered will receive $1,000 for four annual scholarships of $250 each. The department of the institution in which the second award winner is registered will receive $500 for two annual scholarships of $250 each. Similarly the third award winner's department will receive $250 for one annual scholarship. The scholarship awards total $1,750.

*Original Woodcut by Lynd Ward*

**October is the month when many farmers can take a deep breath and relax a bit. Not so in a pipe foundry. We must continue month after month to maintain our rigid quality controls from raw materials to the final test on the finished products. These products, cast iron pipe and fittings, are being constantly produced and shipped to all parts of the country by our plants to meet the urgent needs for water, gas and sewerage service.**

**U.S. cast iron PIPE**

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# NEWS OF Engineers

**Ernest E. Howard** and **O. H. Ammann** have been appointed chairman and associate chairman, respectively, of the United States delegation to the Third Congress of the International Association for Bridge and Structural Engineering, which will be held in Liege, Belgium, in September 1948. They will cooperate with the secretariat in Zurich to facilitate American participation in the affairs of the Congress. As one of the technical advisers to the secretariat, Mr. Ammann will also be in charge of Theme III of the Congress, "Developments in Long Span Steel Bridges." He is a former Director of the ASCE, and Mr. Howard has served the Society as both Director and Vice-President.

Ernest E. Howard

O. H. Ammann

**Stanley I. Pinel** recently rejoined the staff of Griffenhagen & Associates, consultants in management, with offices in Chicago, New York, Boston, Washington and Cleveland, after several years as director of public service for St. Petersburg, Fla. Mr. Pinel is renewing his association with the company in the capacity of principal engineer.

**Howard E. Robbins,** who has been on the staff of the Bureau of Reclamation since 1916, has been appointed acting director for the Bureau in Region 5, with headquarters at Amarillo, Tex. Mr. Robbins' most recent assignment has been as engineer on the Lower Rio Grande Valley reclamation project at McAllen, Tex.

**W. Allan Laflin,** principal engineer for the Food Supply Division of the Institute of Inter-American Affairs, Lima, Peru, has been decorated by the Peruvian government with the Orden del Sol, its highest civilian award. The honor goes to Mr. Laflin in recognition of his work during the past four years with the Servicio Cooperativo Inter-Americano de Produccion de Alimentos, a joint project of the United States and Peruvian governments to improve agriculture and food production in the latter country.

**William Allan** became dean of the school of technology at the College of the City of New York in September. An authority in the field of engineering education, Dean Allan has been on the City College staff since 1933 and chairman of the civil engineering department since February 1940. He is the author of a widely used "Hydraulics Laboratory Manual" and of a number of papers on hydraulics subjects—several of them written, in collaboration with Boris A. Bakhmeteff, Hon. M. ASCE.

**John B. Funk,** consulting engineer of Brunswick, Md., has been appointed to the new post of chief engineer of the Maryland Department of Public Improvements. As a member of the Maryland State Senate from Frederick County and former state senator, Mr. Funk has been active in state fiscal affairs.

**Francis A. Rossell,** until recently a commander in the Civil Engineer Corps of the Navy, has accepted a position with Palmer & Baker, Inc., consulting engineers of Mobile, Ala., for whom he will be chief construction engineer on the vehicular tunnels at Houston and Galveston, Tex.

**Carlton S. Proctor,** senior partner in the New York consulting firm of Moran, Proctor, Freeman & Mueser, has been elected to the Board of ATF Inc., formerly American Type Founders. Mr. Proctor is a former Director of the Society.

**Joseph Hocker** is now office engineer for the Vicksburg District of the Corps of Engineers on the Grenada Reservoir Project at Grenada, Miss. During the war, Mr. Hocker served as a lieutenant colonel in the Army Corps of Engineers.

**Victor J. Richter,** formerly senior construction engineer for the War Department, Washington, D.C., has opened an office for the practice of civil and structural engineering in Silver Spring, Md.

**Samuel B. Lincoln,** vice-president of Lockwood Greene Engineers, New York, N.Y., recently sailed for India in connection with a project for Tata Sons, Ltd., in Bombay. The project involves a complete economic and operating study of the four large textile mills owned by the Tata industries, with the view of adopting modern methods and equipment wherever possible.

**G. M. Wynn,** previously civil engineer in charge of field surveys for the Georgia Power Co., has joined the Auto-Soler Co., Atlanta, Ga., as standards engineer and chief of the company's employee relations and educational program.

**Gilbert C. White** and **Thomas D. Rose** have dissolved their engineering partnership at Durham, N.C. Mr. White has retired, and Mr. Rose will continue the practice of engineering at Chapel Hill, N.C.

**Edwin D. Burchard,** of Raleigh, N.C., is retiring after 23 years as district engineer for the U.S. Geological Survey in charge of surface water investigations in North Carolina. He will be succeeded by **Edward B. Rice,** who has been on the staff of the Survey for the past 18 years—most recently as district engineer at Baton Rouge, La. **William R. Eaton,** formerly associate hydraulic engineer for the Survey at Asheville, N.C., will succeed Mr. Rice at Baton Rouge. Other recent personnel changes announced by the Survey include the transfer of **George E. Ferguson** from the position of district engineer in charge of surface water investigation in Florida to a staff position in the Washington office. **Archibald O. Patterson** has been named to succeed Mr. Ferguson at Ocala, Fla.

**R. Evan Kennedy** is now associated with the Portland, Ore., consulting firm of Moffat, Nichol & Taylor. He has been with the Goodyear Aircraft Corp., of Akron, Ohio, and with the Libby-Sonnen Co., of Madison, Wis.

**Thomas F. Hubbard** has been promoted from the position of associate professor of civil engineering at the Johns Hopkins University to that of professor of civil engineering. Widely known as a teacher and practitioner in the field of city planning, Professor Hubbard has served as consultant to the National Resources Committee, the Maryland State Planning Commission, and the Public Roads Administration. For the past two years he has been chairman of the Baltimore City Plan Commission.

**Eugene L. Grant,** professor of the economics of engineering at Stanford University, has been appointed head of the civil engineering department there.

**Clarence E. Seage** and **Ralph Tudor** have formed the engineering partnership of Seage & Tudor, with headquarters in San Francisco. Mr. Seage previously had a consulting practice in San Francisco, and Mr. Tudor recently resigned as vice-president of Morrison-Knudsen, Inc.

**Harry M. Steward** is retiring as superintendent of maintenance of the Boston (Mass.) Elevated Railway after many years of service in that capacity. He will be succeeded by E. B. Myott, formerly chief engineer. During the war, Mr. Myott served overseas in the Army Corps of Engineers, with the rank of colonel.

MODEL OF FIRST atomic pile built exclusively for peacetime research, at Brookhaven (Long Island) National Laboratory, is inspected by Dr. Lyle Borst (left), atomic pile authority, and Wells N. Thompson, vice-president of H. K. Ferguson Co., industrial engineers and builders in charge of engineering and construction of project. Work on $10,000,000 project has already started, and completion is expected within one year.

# Wickwire Rope is "Tissue Tested"

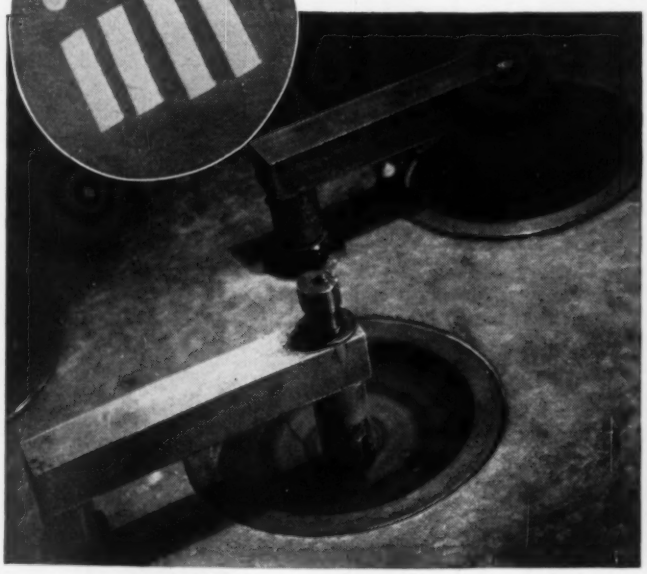
With the same scientific care a physician uses in examining human tissue, technicians in the Physical Testing Laboratory of Wickwire Spencer's Rope Mill test samples of wire imbedded in plastic "buttons." Samples from coils of wire are ground, polished, etched, microscopically examined and the findings recorded.

What's this got to do with wire rope? The grain size has an important bearing on the life span of the wire. Because the quality of the steel in the rope wire is just as important for dependable service as is the construction of the rope, Wickwire uses only such wire as passes the Physical Testing Laboratory's exacting standards.

For the utmost in performance, safety and long life, specify Wickwire Rope. It is available in all sizes and constructions, both regular lay and WISSCOLAY *Pre*formed. Call on Wickwire distributors and Wire Rope engineers to help solve your wire rope problems and supply the right rope for your needs.

**HOW TO PROLONG ROPE LIFE AND LESSEN ROPE COSTS**

Thousands of wire rope users have found that the information packed in the pages of "Know Your Ropes" has made work easier and rope last longer. It's full of suggestions on proper selection, application and usage of wire rope. It's easy-to-read and profusely illustrated. For your free copy, write, Wire Rope Sales Office, Wickwire Spencer Steel, Palmer, Massachusetts.



**WICKWIRE ROPE**

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WIRE ROPE SALES OFFICE AND PLANT—Palmer, Mass. EXECUTIVE OFFICE—500 Fifth Avenue, New York 18, N. Y.

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PACIFIC COAST SUBSIDIARY—The California Wire Cloth Corporation, Oakland 6, California

TWO SHERMANS—Henry J. (left) and Charles W.—meet for first time at Belmont, Mass. Both are life members of ASCE, and both are bank directors. Charles W. Sherman, who is also president of Belmont Savings Bank, has served on numerous Society committees and as reviewer of technical papers for ASCE periodicals. Henry J. Sherman, member of Camden, N.J., consulting firm of Sherman-Sleeper Associates, served as Society Director from 1933 to 1935. Latter has also been active in Philadelphia Section, and played important part in planning program for ASCE Spring Meeting held in Philadelphia in April 1946.

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**Henry E. Struck** has severed his connection as bridge designer for the Illinois State Division of Highways at Springfield, Ill., in order to accept an engineering position with the General Electric Co., at Richland, Wash.

**Thomas L. Cordle** is now city manager of Morganton, N.C. He previously served the city of Lancaster, S.C., in a similar capacity.

**Claude R. McMillan** has been promoted from the position of chief engineer of the South Carolina State Highway Commission to that of chief commissioner. Mr. McMillan has been with the highway department for the past 25 years, and has been chief engineer since 1940.

**William P. Cornelius,** until lately chief of the construction branch of the Atomic Energy Commission at Oak Ridge, Tenn., has been transferred to the Commission's Hanford Engineer Works at Richland, Wash., where he will serve in a similar capacity. A vice-president of the Tennessee Valley Section, Mr. Cornelius was recently elected head of the new Oak Ridge Sub-Section.

**Robert W. Van Houten,** dean of civil engineering at Newark College of Engineering, will head the college for a year while President **Allan R. Cullimore** is on leave of absence. Professor Van Houten will have the title of dean and acting president.

**William J. Keefe** is now superintendent of rolling stock for the Eastern Massachusetts Street Railway Co., with headquarters at Campello, Mass. For the past 20 years Mr. Keefe has been chief engineer of the Massachusetts Department of Public Utilities in Boston.

**E. L. Pavlo,** formerly chief engineer for the New York firm of Madigan & Hyland, has established a civil engineering practice at 165 Broadway, New York, N.Y. He will specialize in bridges, buildings, foundations, expressways and harbor works

**Col. Edward A. MacMillan,** civil engineer of Princeton, N.J., has been assigned as commander of the 190th Composite Group, Organized Reserve, Trenton, N.J. Called to active duty in February 1941, Colonel MacMillan served at the headquarters of the Eastern Defense Command, Governors Island, N.Y.

**Marshall I. Loughin** recently resigned as structural engineer in the Denver, Colo., office of the Bureau of Reclamation to accept a position in the field organization of the Chicago district of the Austin Co., engineers and builders.

**Felix A. Wallace,** formerly on the civil engineering staff of the Carnegie Institute of Technology, has been named head of the new department of civil engineering at the College of the Pacific in Stockton, Calif. Commissioned in the Navy in 1942, Mr. Wallace served as officer in charge of the U.S. Naval Base at Almirante, Republic of Panama, and later went to the Tobago, Canal Zone, base as officer in charge of all engineering and public works activities.

**William E. Corfitzen,** of the Bureau of Reclamation staff, left New York on September 9 for Greece, where he will be irrigation adviser in the rehabilitation of irrigation works on 800,000 acres of farmlands, as part of the American Mission for Aid to Greece. Mr. Corfitzen, who has been principal liaison officer for the Bureau with irrigation officials of foreign nations, has been loaned to the State Department for a year to expedite the reconstruction of canals, headworks and other irrigation structures. He has been with the Bureau of Reclamation since 1933

**George Farrell** was recently appointed city engineer of Columbia, Mo. During the war, Mr. Farrell served as a colonel in the Missouri State Guard, and he was at one time city engineer of Hannibal, Mo.

**George R. Rich,** for the past two years on the engineering staff of Charles T. Main, Inc., Boston, Mass., has been made a member of the firm. Prior to his affiliation with the firm, Mr. Rich was design engineer for the TVA at Knoxville, Tenn.

**Calvin V. Davis** has severed his connection as Southern manager for the Frederic R. Harris Engineering Corp., at Knoxville, Tenn., to go to the Argentine as adviser to the government in its five-year program of hydroelectric development. Mr. Davis was at one time principal planning engineer for the TVA on several of its large dam projects.

**Kenneth Thompson,** previously with the Wiggert & Dean Engineering Co., at Daytona Beach, Fla., has accepted a position in the sanitary engineering department of Gilbert Associates, Inc., Reading, Pa.

**James B. Ward** is now with the Inter-American Corp., stationed at Buenos Aires, Argentina. He was formerly district geologist in the U.S. Engineer Office at Mobile, Ala.

**Frederick C. Schlemmer,** manager for the Peerless Wollen Mills at Rossville, Ga., has been named a special engineering consultant to the Atomic Energy Commission. He will advise the Commission on its new construction projects on a part-time basis.

**Francis W. Herring,** of Washington, D.C., has been named chief of the Port Planning Bureau of the Port of New York Authority. In his new post he will be responsible for planning and economic studies. A former commander in the Navy Bureau of Yards and Docks, Mr. Herring has also been executive director of the American Public Works Association and deputy chairman of the facilities committee of the War Production Board. He was at one time assistant editor of *Engineering News-Record*, and is the author of many articles on municipal engineering and administration.

F. W. Herring

**Lewis P. Bradford** has resigned as civil engineer for the Tennessee Valley Authority at Knoxville, Tenn., to join the staff of the city engineer of Jackson, Miss.

**Wilfred L. Karrer,** until lately in the Boise, Idaho, office of the U.S. Bureau of Reclamation, as chief of the Branch of Design and Construction, has been appointed construction engineer in charge of the rehabilitation of the Bureau's Lewiston Orchards Project.

**A. Diefendorf,** professor and head of the department of civil engineering at the University of Utah, spent the summer inspecting new highway projects in South America and the Caribbean islands, particularly Cuba.

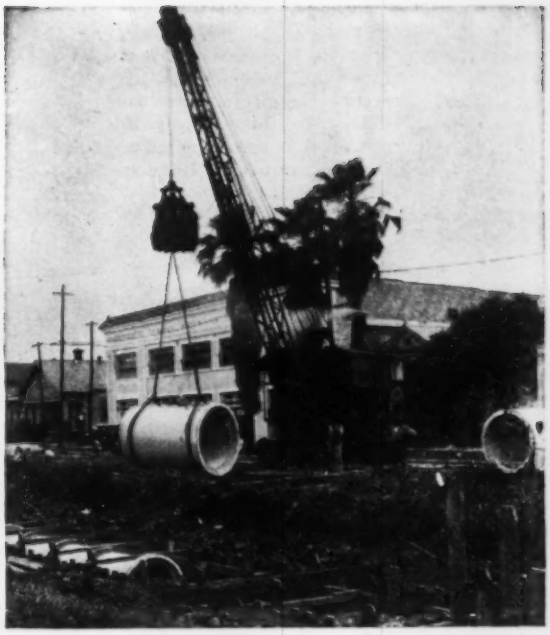
## Deceased

**Justo Arrastia** (M. '39) head of the department of civil engineering at the University of the Philippines, Manila, P.I., died in February 1947. Word of his death has just reached the Society. Mr. Arrastia, who was 51, was educated in the Philippines and at Cornell University. In 1926, following early engineering experience in the Philippine Bureau of Public Works, he established a private practice in Manila. Since 1935 he had been at the University of the Philippines.

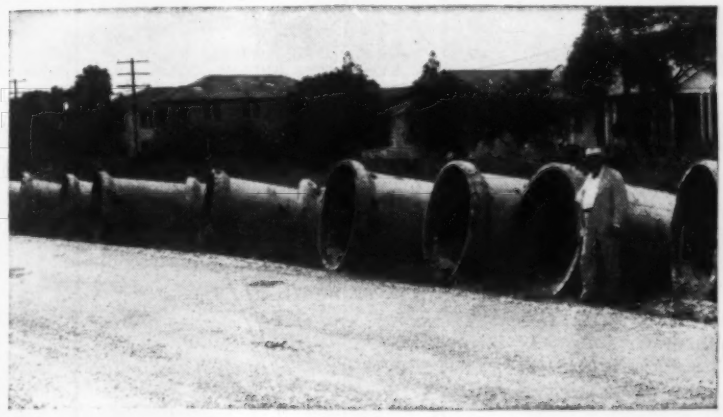
**John Sadler Barlow** (M. '20) consulting engineer of Dallas, Tex., died at his home there on August 29, at the age of 65. From 1912 to 1919 Mr. Barlow was division engineer for the Arizona State Highway Department, and from 1919 to 1922 he was with the Elrod Engineering Co., of Dallas, Tex. For some years he had a consulting practice in Dallas, specializing in municipal problems and improvements. As engineer for the Federal Works Agency at Fort Worth for five years preceding World War II, he played a prominent part in the development of the Corpus Christi Naval Air Station.

**Alexander Sylvester Hamill** (Assoc. M. '09) president of the Alexander Hamill Iron

# CONCRETE PIPE laid in 1927. . . .



Photos courtesy Sewerage and Water Board of New Orleans



# Taken up and RE-USED IN 1947!

TWENTY YEARS ago New Orleans laid a 42″ and 48″ concrete pipe sewer in the bed of an old open drainage canal. In 1947 the city decided to build a wide covered drainage canal on the site. When the old concrete pipe was taken up, it was found to be in such excellent condition, that it will be re-used elsewhere in the city.

Thus is demonstrated again the durability, the structural strength and high wear resistance of concrete pipe. Concrete pipe provides maximum hydraulic capacity. Tight joints and uniformly dense concrete insure minimum infiltration and leakage. First cost is moderate. And as for life-long economy, consider the case of New Orleans!

## AMERICAN CONCRETE PIPE ASSOCIATION

228 NORTH LA SALLE STREET, CHICAGO 1, ILLINOIS

Works, Jersey City, N. J., died suddenly on August 31. Mr. Hamill, who was 68, had for many years been connected with the iron works, which were founded by his father. The organization turns out structural and ornamental ironwork. Long interested in public service, Mr. Hamill served for fourteen years as president of the Jersey City Board of Education.

**Mark Arthur Hammond** (Assoc. M. '21) sales engineer for the Electric Boat Co., Groton, Conn., died on August 17, at the age of 59. Mr. Hammond had been with the Lackawanna Bridge Co., Buffalo, N.Y., and the Submarine Boat Corp., Newark, N.J. For several years he had his own construction engineering company in Philadelphia, and later served as regional reconditioning supervisor for the Home Owners Loan Corp. in New York City and Cincinnati, Ohio. He became assistant to the general manager of the Electric Boat Co. in 1943.

**Kenneth Lee Hyder** (M. '36) vice-president and director of the American Appraisal Co., Milwaukee, Wis., died there on August 11, at the age of 59. Mr. Hyder was an architect in Cincinnati and Detroit before joining the appraisal company in 1918. He became vice-president of the organization in 1935, and from 1939 to 1945 was in charge of the company's Chicago office. Mr. Hyder had served as managing editor of *The Appraisal Journal* and, at the time of his death, was consulting editor.

**James Warren Ingalls** (Assoc. M. '18) associate professor of industrial research at Norwich University, Northfield, Vt., died on July 22, at the age of 60. Mr. Ingalls spent his early career in railroad engineering—as resident engineer for the Maine Central from 1913 to 1919. From 1921 to 1927 he was associate professor of civil engineering at Northeastern University, and from the latter year to 1935 professor of industrial engineering there. Since 1939 he had been associate director of the Bureau of Industrial Research at Norwich University.

**William E. Wickenden,** professor emeritus of the Case Institute of Technology, Cleveland, Ohio, died in a hospital in Peterboro, N.H., on September 1. Dr. Wickenden was president of the Case Institute (formerly the Case School of Applied Science) from 1929 until his official retirement the day before his death. His age was 64. For six years prior to assuming the presidency of the Case Institute, he had been director of investigation for the Society for the Promotion of Engineering Education. A member of many engineering societies and holder of eleven honorary degrees, Dr. Wickenden had served as president of the American Institute of Electrical Engineers and as chairman of Engineers Joint Council. Shortly before his death he was named by EJC as its representative on the United States Commission for UNESCO.

W. E. Wickenden

## G. W. Kittredge, Hon. M., and Former ASCE Officer, Dies

MEMBERS OF THE Society will be saddened to hear of the death of Honorary Member George W. Kittredge, former chief engineer for the New York Central Railroad, who died at his home in Yonkers, N.Y., on August 22. He was 90. A full member of the Society since 1886, Mr. Kittredge was third on the list of veteran ASCE members.

At the time of his death he was also one of the oldest alumni of the Massachusetts Institute of Technology, from which he was graduated in 1877. Last June he was one of two members of the class returning to M.I.T. for their 70th reunion.

**THE LATE GEORGE W. KITTREDGE, Hon. M. ASCE and former Society officer, celebrated his 90th birthday at dinner given in his honor a few months before his death—in Yonkers, N.Y., on August 22.**

Mr. Kittredge began his railroad career in 1880 as a civil engineer for the Pennsylvania Railroad. In 1890 he was made assistant chief engineer of the Cleveland, Cincinnati, Chicago & St. Louis Railway (known as the Big Four). He became chief engineer of the Big Four the following year, holding that position until he was appointed chief engineer of the New York Central Railroad in 1906. He retired in 1926.

During his long tenure with the New York Central, Mr. Kittredge supervised the design and construction of the Grand Central Terminal in New York City, the Albany freight terminal, and the West Side rail and elevated boulevard project in New York. For a number of years following his retirement, he acted as consultant for the New York Central and other lines in the United States and Canada.

From 1911 to 1927, Mr. Kittredge was vice-president of the Eastern Railroad Association and a member of its executive committee. He was also a past-president of the American Railroad Engineering Association. He served the ASCE as Director from 1908 to 1910, and as Vice-President during 1917 and 1918. He was also active in committee work and on the Engineering Societies Library Board.

**L. Sterling Boggess** (Assoc. M. '16) civil engineer for the Public Roads Administration, attached to the Guatemala project of the Inter-American Highway, died suddenly in Guatemala City on August 18. He was 60. From 1908 to 1920 Mr. Boggess was in the Philippines, where he served as an engineer on various public works projects. On his return to the United States, he was project engineer for the Oklahoma State Highway Department and designer for the Missouri Highway Department. In 1943 he went to Central America for the PRA.

**Joseph Henry O'Brien** (M. '05) since 1934 vice-president of the Petroleum Heat & Power Co., New York, N. Y., died in a hospital in Yonkers, N. Y., on August 30. He was 73. While with the Westinghouse, Church-Kerr Engineering Co., Mr. O'Brien was engaged on the design and construction of the Pennsylvania Terminal in New York. He also assisted in the design and building of South Station in Boston and the Canadian Pacific's railroad terminal in Montreal. On the staff of the Foundation Co. of New York for twelve years, he served that organization as chief engineer, vice-president and general manager, and later was consulting engineer for the New York firm of Gibbs & Hill. In the latter capacity he was instrumental in designing and supervising the electrification program of the Pennsylvania Railroad.

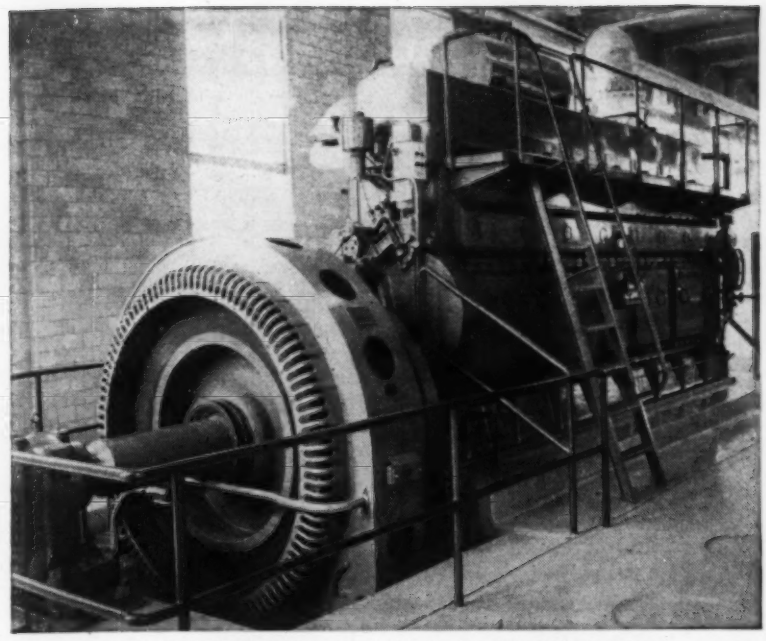
**Jerome Branch Stocking** (Assoc. M. '12) water master and engineer for the North Side Canal Co., Jerome, Idaho, was burned to death in a brush fire on July 9 while checking canal equipment. Mr. Stocking, who was 73, had been engineer and water master for the North Side Canal Co. since 1921. Earlier in his career he had been Idaho state engineer and assistant chief engineer for the Twin Falls Salmon River Land & Water Co.

**Charles Joseph Thiel** (Assoc. M. '40) civil engineer of Dayton, Ky., died at his home there on July 20, at the age of 53. A lifelong resident of Dayton, Mr. Thiel had served that municipality and Bellevue, Ky., as city engineer. For the past twelve years, he was engineer for the Campbell County (Kentucky) Fiscal Court.

## Engineers, Businessmen Study Urban Traffic Problems

(*Continued from page 39*)

Aid Highway Act of 1944 if we were to emphasize unduly the direct fiscal benefits of the act to cities," Mr. MacDonald said and, in part, continued: "More importantly, the act aims at nothing less than the achievement of an integrated development of all the major classes of streets and highways, comprising the nation's street and highway network (see CIVIL ENGINEERING for September, page 55). This integrated national network will probably serve not less than 85 percent of the total vehicle-mileage of highway transportation, and will accomplish this large measure of service by the inclusion of not



*Type SEHGO-8 supercharged Worthington Dual-Fuel Diesel engine*

# Supercharged Dual-Fuel Diesel Goes Into Service— Over 36% Thermal Efficiency

What can be accomplished by supercharging a dual-fuel Diesel has been demonstrated by the performance of the new Worthington engine in the municipal power plant at Lamar, Colo.

This 1530 hp engine, recently installed to drive a 1080 kw generator, has turned in a record of over 36% thermal efficiency—7050 net btu per brake horsepower hour (total of gas and pilot oil fuels) at full load. Elevation is 3600 ft.

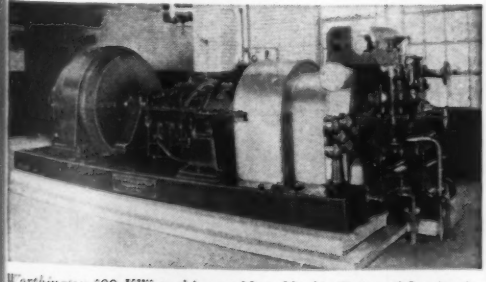
Worthington achievements in producing the first U. S.-built 4-cycle dual-fuel engine and the world's first supercharged engine of this type were among the reasons why Lamar selected Worthington equipment, to take care of its greatly increased demand.

The Worthington engine at Lamar uses natural gas on the Diesel cycle, but in case of gas line failure, it is quickly convertible (by a turn of a wheel) to Diesel oil or any mixture of gas and oil. With gas, the fuel cost is slightly more than one mill per kw.

The supercharger utilizes the energy of the engine exhaust to drive a blower which supercharges the engine. In addition to increasing horsepower about 50%, this improves mechanical efficiency and scavenging, resulting in lower fuel consumption. Lubricating oil requirements are also reduced. Further economies result from the lower installation cost: less building space, smaller foundations, etc.

Activity in the Lamar territory has increased so much in the past six years that the power plant has been hard pressed to keep its customers supplied. Construction of a new dam a few years ago doubled the load, and the expansion of the local milling industry further increased the load so that Lamar needs, today, three times the power it used in 1940 (and 18 times the power used in 1921).

The new generating unit is being used for peak loads and standby services.



*Worthington 500 KW turbine at New York's Dept. of Sanitation Incinerator Plant on 56th Street.*

## The Incinerator on 56th Street

New York City maintains an incinerator plant on 56th Street. This plant uses the heat generated in burning refuse to make power for operating cranes, lights, plant auxiliaries.

Two Worthington 500 KW alternating current geared turbine-generator units supply the power. They were installed in 1936. They operate on steam at 200 lbs. pressure supplied from the waste heat boiler and exhaust at 5 lb. back pressure.

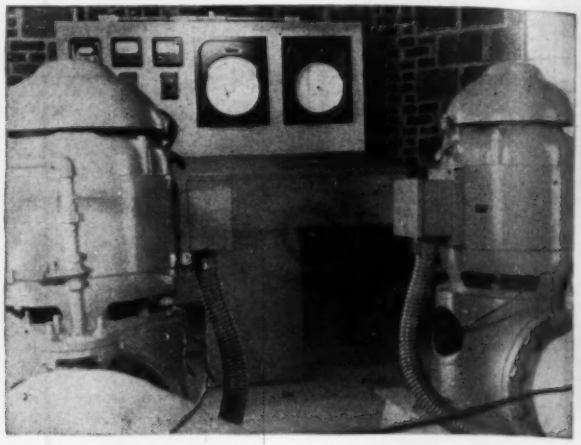
NEWS

FROM THE PUBLIC WORKS FRONT

AS REPORTED BY THE DEVELOPMENT ENGINEERS, FIELD SERVICE REPRESENTATIVES AND CUSTOMERS OF WORTHINGTON

1

# Worthington Helps Ranney System at American Cyanamid



*Two Worthington turbine pumps in American Cyanamid Company pump house.*

American Cyanamid Company's new plant in Wallingford, Conn., is located on sandy flats.

One of the principal problems was to find a suitable source of process water. The plant being located in a valley, it was presumed that enough ground water would be available. But after six wells had been placed in operation, it was found that the geological formation was such that the water supply dwindled, leaving no reserve for plant expansion.

A survey of subterranean water sources was made by an experienced geologist who disclosed that a valuable aquifer existed on the property. One of the latest types of water collecting system, designed by the Ranney Water Collector Corporation, was installed.

### Worthington In the Pumping Station

The system works this way. 1, A large area of water-bearing formation is exposed to horizontal screen pipes located below the ground water table. 2, Selective removal of the fine material from the aquifer in the vicinity of the screens and the formation of more permeable ground or a gravel pack adjacent to the screen produce a series of radiating drainage canals emptying into a central shaft. 3, The lines lead to portholes in the lower section of a concrete cylinder, sealed at the bottom.

This compact unit is capable of producing, for American Cyanamid Company, 5 million gpd. The water is colorless, odorless, tasteless and bacteria-free due to the large infiltration area and the 80-ft depth of sand and gravel through which it travels to the pipes.

Two Worthington turbine pumps were selected for the pumping station. Each has a capacity of 100 gpm. The flexibility provided by the Worthington design is ideal because added capacity can be obtained from each pump at moderate additional cost.

Water from the caisson bottom is pumped to a tank above ground to feed two Worthington centrifugal Monobloc pressure pumps supplying the plant pressure system.

Operation of the water system is entirely automatic. The well pumps are controlled by the water level through contact electrodes in the above-ground supply tank, and the pressure system is controlled by live pressure.

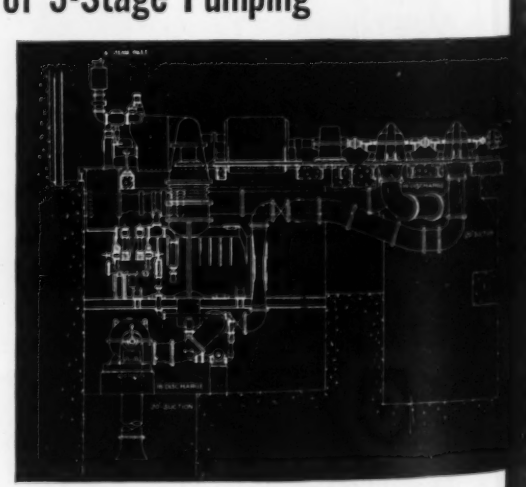
## Unusual Design of 3-Stage Pumping

Back in 1928, the South Pittsburgh Water Company installed an unusual Worthington pumping unit for 12 mgd against 370 ft TDH at 1140 rpm. Its success led to installation of a second unit in 1933 for 13 mgd against 370 ft TDH at 1140 rpm. (A third unit for similar service is now under construction.)

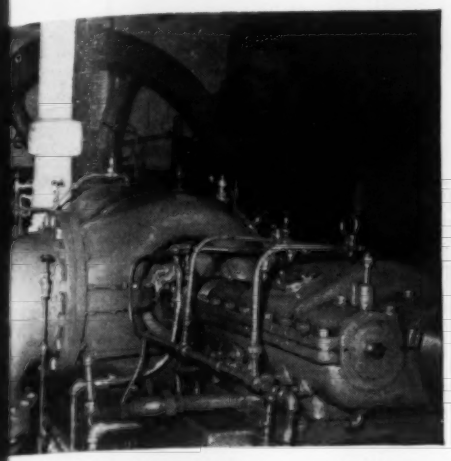
These pumping units are really "three stage". The first stage units are 18 in. Worthington motor-driven pumps located in the basement within reach of the water in suction wells. Power for first stage pump motors is furnished from generators on the main floor, forming a part of the pumping units.

The two main pumping units are on the engine room floor. They each consist of steam turbines direct-connected to generators and two 18 in. Worthington pumps in series.

Power developed by the generators is also used for motor-driven pumps at another station.



*15 mgd Worthington Centrifugal pumping unit and 2,000 kw gener... South Pittsburgh Water Company*



*ston-Moore Steam Turbine driving two centrifugal Old Worthington steam engine shown in background.*

# lore Power from maller Packages Experienced at Canoe Brook

he extent of engineering progress in pump- g station equipment is dramatically illus- ted by installations of Worthington equip- nt at the Commonwealth Water Company's noe Brook Pumping Station in Summit, w Jersey. This company, an affiliate of the nerican Water Works and Electric Company ., supplies water to the municipalities and communities in that part of New Jersey, d the Canoe Brook Station is one of three mping stations.

One of the biggest pieces of equipment is a rthington compound crosshead steam en- e and displacement pump installed in 1924. has a daily capacity of 6,000,000 gallons is still performing with complete satis- tion. It takes up 50 ft by 25 ft and the fly- eel alone weighs 75 tons.

By comparison, the Worthington-Moore bine recently installed to drive two cen- ugal pumps with a total capacity of 5,000,- 0 gpd, requires much less floor space—the l equipment occupies less than one-tenth space, but has five-sixths the capacity of older engine and pump.

mproved simplicity is demonstrated by the bine combination in which all valves and kages have been eliminated. With the ex- tion of the gear box, all of the elements ntain only one moving part.

*Ransome Blue Brute 34E Dual Drum Paver discharging into a batch hopper.*

## World's Record on Dual Drum Pavers

The ten Ransome Blue Brute Dual Drum Pavers owned by S. A. Healy Company of Chicago give this company what is believed to be the largest number of same-make dual drum pavers owned by a single company.

But none of those machines has ever been used as a paver!

Like the Ransome high-elevated-boom pavers used by the U. S. Government at the Grand Coulee Dam and by many private contractors for building construction work, these machines actually serve as mobile mixing plants.

The combination of fast hydraulically-controlled boom swing and hydraulically-controlled discharge bucket makes it possible to concrete isolated bridge piles and thin walls or to load trucks, batch hoppers, etc., without the dangerous working hazard of a man on top of the form or hopper.

The design gives a clearance of 20 ft. from bucket to ground at the outer end of the boom. The bucket has a self-leveling device and an automatic lock. If the bucket cable should break, the automatic lock holds the loaded bucket at any position on the boom, thus preventing the bucket from running down the boom and crashing into the mixer.

These Blue Brute machines are being used on such jobs as the Chicago Subway system, the Union Stock Yards sewers and the Neversink Dam at Luzon, N. Y.

---

## 57-Year-Old Pump Makes "Good Buy"

Worthington Pittsburgh office was recently asked to look up the records of a certain 12x7x10 duplex, piston-pattern, direct-acting pump. The inquirer said this pump was in excellent condition and that he could buy it for $450.00.

A search of the records revealed that that particular pump had been built in 1890!

7-12

Worthington Pump and Machinery Corporation

•

Harrison, N. J.

much more than 20 percent of the total mileage of roads and streets.

"It is in its requirement of the planning of these systems, rather than in the appropriations it authorizes for a short term of years, that the great fundamental merit of the 1944 act is to be found. The great difference between the new and the old programs, as far as the cities are concerned, is that the cities are to be as closely associated in the new as they were definitely excluded at the inception of the old program.

"The time when highway needs of the cities might be regarded as of lesser concern than rural needs is past, and too long past. No finding of the statewide highway planning surveys is more clearly established than the fact that the tides of rural highway movement have either their origins or destinations predominantly in the urban areas. No longer tenable is the idea, once prevalent, that cities are places to be avoided or bypassed by through highways. With certainty we know now that the traffic that moves on these primary rural highways in the vicinity of every city is, in its majority, a traffic destined to, or originated in, the city; that this majority rises to 90 percent or more in the vicinity of the largest cities, and remains substantial in the vicinity of cities much smaller, even down to the town of 5,000 population. It is clear, therefore, that the rural highways must have adequate connection into and through the cities if their traffic is to be properly facilitated to its predominantly city destinations, and from its predominantly city origins.

"In its relation to the cities, the federal program contemplates, first, a clear definition of essential lines of arterial movement, and thereafter a sustained application of city and, perhaps, state funds annually available, with federal aid, over what may well be the long period necessary to develop, in each city, a needed system of highways designed for the special service of arterial traffic. The program will not exclude any needed provision of outer circumferential highways, though it may properly contemplate the location of such routes in such manner as to serve the need for connection between outlying urban sections, as well as the more commonly recognized objective of city avoidance for through-highway traffic.

"Federal funds are available and have already been used on surveys undertaken in more than 60 cities. Preliminary engineering reports have been made or are to be made in 100 cities large and small. As of August 15, more than 85 percent of the urban-area funds authorized for the first postwar year had been programmed for specific projects, and nearly 50 percent of the funds authorized for the second year had been programmed.

"Of the combined apportionments for the fiscal years 1946 and 1947, amounting to $243,750,000, only $6,130,450, or 2.5 percent have been programmed for improvements which will not provide at least one additional traffic lane. Especially pleasing are 144 projects which will result in the construction of 138.3 miles of new urban expressways, with all intersection grades separated and complete access control. To these goes the largest share of the apportioned funds, an allotment of $77,412,645, or 31.8 percent of the total. Properly, these projects are located in the larger cities. Their completion will nearly duplicate the mileage of urban expressways now existing.

"There is altogether too much fear of the so-called decentralizing effect of expressways. The type of decentralization now in progress is inevitable, expressways or no expressways. It is fortunate, and not a catastrophe, that people are establishing their homes outside the central city areas. The space thus vacated is needed for other public purposes. It is a happy circumstance that living conditions for the family can be reestablished and permit the social, as well as economic decay in the heart of the cities to be converted to a public asset. It is certain that the cities face a bright, rather than a disastrous future, if faith and courage are at the helm."

## Meteorological Engineering Aids Highway Transportation

(*Continued from page 43*)

acting on reliable information only a few minutes old, can stay off the roads when conditions are bad and travel when they are favorable. Since poor road conditions are involved in about 6,000 fatal accidents a year,[7] a reduction of even a small percentage of such accidents is important. Additional benefits include more efficient routing of commercial and private vehicles and the avoidance of costly delays.

### Conclusion

Applications of meteorological engineering discussed in this article are suggestive only. The possibilities have by no means been exhausted. Careful examination of the problems of the highway user and the resources of the meteorological and highway engineer will reveal many possible approaches to the problem of reducing the weather risk. The technical difficulties arising in the direct solution of the problem are surmountable; the great need at the present time is recognition of the necessity for cooperative action.

## Restoration Work Prolongs Life of Concrete Structures

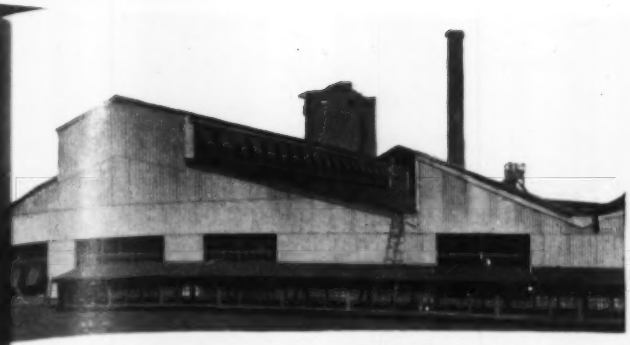
(*Continued from page 26*)

penetrations. (Fully 75 percent and possibly 90 percent of the restoration work is on downstream faces of defective gravity dams whose upstream faces are not accessible, and where hydraulic conditions, or considerations of cost, require that the concrete surface be restored.)

In studies of this subject the Thomson Dam has always served as a criterion for certain fundamentals. Experience with the Thomson Dam has shown that concrete can be built to endure local conditions. Renovated structures are compared with similar work at Thomson as a criterion for proper methods and quality of work. Accompanying views and their descriptive captions give details of restoration work performed on several of the problem dams.

The fundamental rules observed in these concrete restoration operations, which are generally rather small in terms of volume of new concrete, are as follows:

1. Good aggregate is selected. Nearby supplies of excellent sand and gravel having State Highway Department approval are usually available.
2. Cement without admixture—a bit too much, rather than too little—is used.
3. Mixing water in excessive quantities is not permitted.
4. Good batch temperatures are used in cold weather and green concrete is kept protected for proper curing.
5. Concrete is placed carefully to avoid segregation, toward which end proper use of pneumatic vibrators helps considerably.
6. A mat of well-reinforced new concrete, usually of 2 ft or more in thickness, is placed on a surface that results from chipping away all old material which shows any indication of having lost its original characteristics. Dowels are set to a depth



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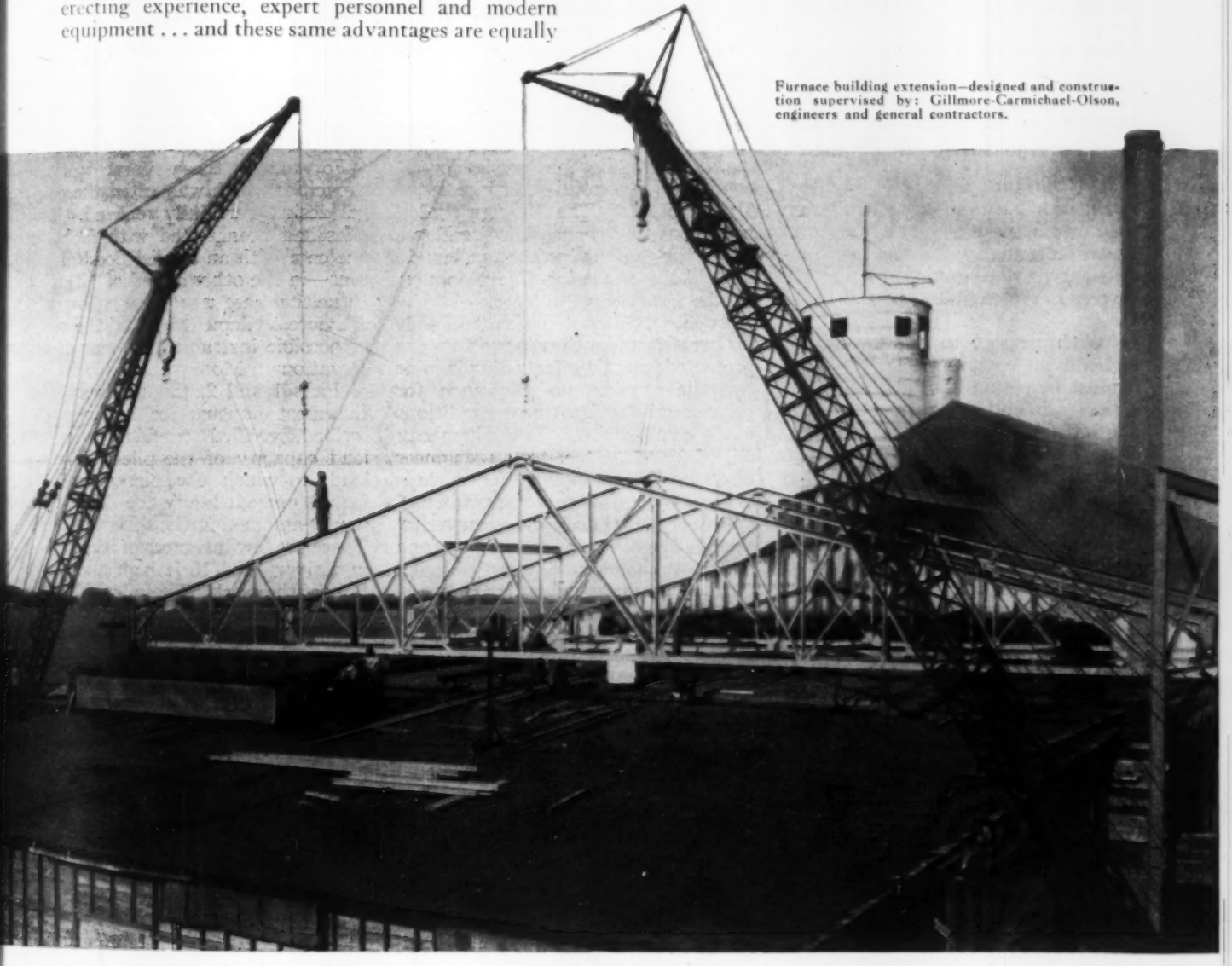
Furnace building extension—designed and construction supervised by: Gillmore-Carmichael-Olson, engineers and general contractors.



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beyond frost penetration, usually of 1-in. steel, 3 ft on centers both ways. Horizontal and vertical steel, of the same size and spacing, is then physically attached (often by welding) at all dowel points. In some cases, additional lighter steel is used to make either the horizontal or the vertical spacing, or both, 18 in. between bars.

Prior to 1934, L. M. Pharis, M. ASCE, was chief engineer, under whose general supervision the policy of the company was developed. In 1934 C. C. Boswell succeeded Mr. Pharis as chief engineer. The writer developed the details of all this program of work, which was carried out by the company forces in charge of A. E. Bradley, superintendent of heavy maintenance and construction.

## Income Tax Requirements Affect Foreign Service of Engineers

(*Continued from page 46*)

gaged in a business or profession on their own account), and all other pertinent facts that will assist the Commissioner in determining whether the taxpayers are eligible for these benefits.

"With respect to the matter of higher living costs in foreign countries it must be pointed out that personal expenses do not, in general, constitute allowable deductions from gross income under section 24(a)(1) of the Internal Revenue Code, and this is not altered even though such expenses are higher in foreign countries. So-called "foreign allowances" paid to employees in addition to a regular salary represent additional compensation for personal services which are includible in gross income. In a case where the provisions of section 116-(a)(1) are applicable, such allowances of course form part of the exclusion.

"Under section 131 of the Internal Revenue Code a citizen may credit against his federal income tax, the amount of any income, war-profits, and excess profits taxes paid or accrued during the taxable year to any foreign country, subject, however, to the two limitations: (1) the amount of the credit in respect of the tax paid or accrued to a foreign country shall not exceed the same proportion of tax against which such credit is taken, which the taxpayer's net income from sources within such foreign country bears to his entire net income for the same taxable year, and (2) the total amount of the credit shall not exceed the same proportion of the tax against which such credit is taken, which the taxpayer's net income from sources without the United States bears to his entire net income. To support the credit claimed for foreign taxes, Form 1116 must be executed and filed with the federal return. Under Schedule G on page 3 thereof the method for computing the amount of credit allowable, is fully set forth."

As applied to the engineer, the foregoing statement of the income tax law penalizes those engaged on construction projects that will have a completion date, and those who accept higher compensation for primitive conditions, risk of disease and inflated costs.

Long continued foreign service as a bona fide resident must be questioned as being desirable for professional development in the majority of cases. Too often the engineer who remains for long in a foreign land loses his American contacts, has little to offer the profession in his homeland, and by long absence is subject to a handicap in losing the very philosophy needed for the conduct of successful enterprise in the United States. The "foreign trade" provisions for bona fide residents under the present income tax law do not aid the professional development of the American engineer. At the same time, other Americans eligible for benefits under these provisions are protected from the effects of an income tax that makes no allowance for salaries adjusted to meet conditions of foreign service. That these can be of consequence to an engineer hired for construction in Venezuela is evident by considering the graduated nature of the tax and local opinion that salaries must be adjusted to allow for a dollar worth 30 cents in cost of living terms. Engineers must move to the job to gain experience and advance professionally, but unusual penalties to such advancement appear contrary to the national interest.

Interest in this subject developed when an acquaintance with a capable background declined a lucrative offer in India because the income tax on the higher salary became so great that the unfavorable factors outweighed the incentives. A consultant known to all American engineers had suggested the offer. The project is of the first magnitude and those in responsible charge of design will gain valuable experience available only on a small number of similar structures.

Inquiry at the office of the local Collector of Internal Revenue showed that the higher tax upon the overall income was so great that the compensation for leaving other interesting employment in the United States became insignificant although the experience was still desirable. This was particularly true when weighed along with the risks from disease inherent to life in undeveloped parts of the tropics. This particular offer may be raised and the experience still go to an American engineer, but live foreign competition will make such arrangements less likely in the future.

If the engineering profession agrees, it is suggested that the value of foreign employment be reviewed and that an agency such as the Engineers Joint Council recommend and support changes in the present law to encourage the maximum professional development.

Illustrations for this article are used through courtesy of the Caterpillar Tractor Co.

## Tubular Steel Pile Piers Withstand Rigid Test

(*Continued from page 17*)

Fortunately the assurances of pile capacities which warranted the original design were fully realized. Two piles had been tested with jacks, in one case with an applied load of 150 tons—in the other a load of 190 tons. In neither case was there substantial ultimate settlement beyond the range of possible instrumental error of observations. Moreover, the behavior of Piers 1 and 2, when subjected to the most unusual ice loads as described, verified confidence in the load capacity of the piles. The ice loads to which the piers were subjected exceeded any ice load commonly assumed in the design of piers. There are few instances of ice moving in a river piled 15 ft high above the tops of the piers. The piles therefore evidently had excess capacity.

To provide additional assurance of meeting the requirements of the revised plan, it was recommended that the three downstream piles of each pier be driven down to show an indicated load capacity of 180 tons per pile. The feasibility of this action was determined by additional driving of a downstream pile of Pier 3. This pile indicated a bearing capacity of 150 tons at a penetration of 90 ft below water. A load capacity of 180 tons was indicated at an additional penetration of 15 and 18 ft with virtual refusal in the last moments of driving. There was no evidence of damage to the pile or to the pile-driving equipment from the intensity of the driving.

The concrete cap beams of Piers 1 and 2 were built up the additional 10 ft of height, with suitable details for anchoring the reinforcing steel in the new part to that below. No addi-

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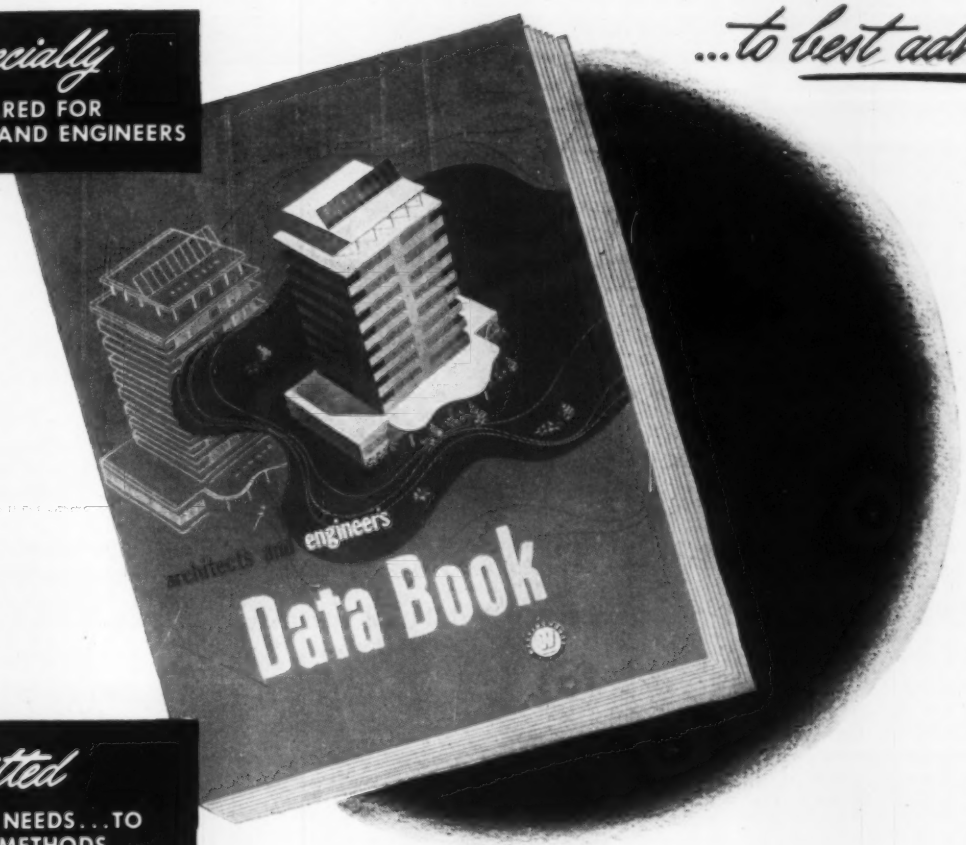


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tional pile support could be readily provided, but the behavior of these two piers seems to justify the opinion that they would care for the additional loads without distress.

### Establish Pier Building Record

The facility with which the piers have been built, with the admirable plant equipment and conduct of the work by the contractor, Missouri Valley Constructors, Inc., and Winston Brothers Co., is evident in the fact that all piers and abutments were completed by last July 31, three months after plan revisions were determined. After the procedure had been established, one week sufficed to drive all the piles of a pier and move to the next pier; thus each seven days the principal work of building a pier was completed. No record of comparable time for pier building in the Missouri River is known.

The construction cost of an average pier as revised, was about one-half that which a caisson pier would have cost—based on the costs of the caisson piers of the Milwaukee–Rock Island Railroad Bridge at Kansas City, the most recently completed Missouri River Bridge, with costs adjusted to the same construction period. Patent applications on critical features of these piers are in progress.

## Broad Aspects of Highway Planning Affect Nation

(*Continued from page 31*)

purely land-service road provides access to property and is almost entirely of direct benefit to the abutting owners while the trunk highway is an element of transportation and is of large benefit to the region, to the state, and in many cases to the national economy. This is a large and pressing problem since state legislators are constantly subjected to pressure from rural areas for a larger "cut" of state motor-vehicle revenues to be spent on local land-service roads.

It is difficult for the landowner bogged in the mud in an isolated rural area to understand benefits accruing to him by the expenditure of millions on express highway facilities in highly developed urban areas. It is essential that there be a fundamental clarification of what land-service roads should be supported entirely by land taxes collected from local landowners, what land-service roads should be supported partly by the landowner and by motor-vehicle revenues and an equitable ratio setup. Where there is state participation in local road construction and maintenance utilizing motor vehicle revenues, a determination should be made by the state as to which roads should be improved on the basis of the service to be rendered by such road to the state-wide feeder system of highways. This indicates the desirability of developing a state-wide feeder system of highways properly integrated with the main system.

In addition to intra-state planning it is necessary to plan on an interstate and national level in order to assure the development of a system which contemplates adequate interchange between adjoining states and integration into the national system. The adoption of the national system of inter-regional highways is an expression of highway planning at the national level.

Practical examples of current cooperative highway planning between adjoining states are the planning of the Palisades Interstate Parkway in northern New Jersey and southern New York (where the two states have collaborated in the development of a proposed new parkway route extending from the George Washington Bridge along the famed Hudson River Palisades to Bear Mountain Park), the Trenton expressway, and a transstate freeway to connect with the proposed Delaware River Bridge between New Castle, Del., and Deepwater, N.J.

**This article is based on a paper presented before a recent joint meeting of the ASCE Philadelphia Section and the Trenton Engineers Club.**

## Outdoor Laboratory Provides Data on Marine Corrosion

(*Continued from page 34*)

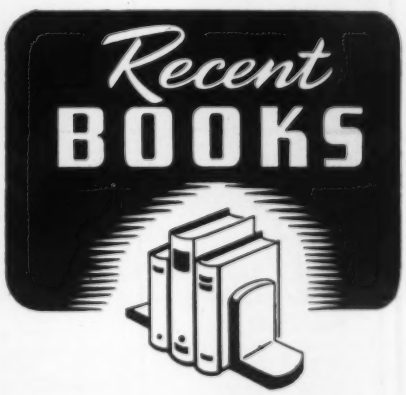
by determinations of weight loss, changes in mechanical properties, or both. The insulated test frames may accommodate several types and sizes of specimen. Usually a sufficient number is exposed originally to permit withdrawal in groups of from two to five for observations of changes in corrosion rates with time. New specimens of key materials are put on the racks each time a large group is removed or a new group installed to provide information on changes in the corrosivity of the atmosphere itself.

Sea water spray is combined with sea air on a site about 50 ft from the shore, where air frequently is laden with concentrated spray from the ocean driven by winds of varying velocity against the specimens. A stand about 8 ft high and roughly 100 ft long by 15 ft wide supports both Monel and wooden racks, some vertical and others at the 30-deg angle used for the atmospheric tests. There are about 200 samples of materials under examination, including 20 springs typical of those used for railroad cars.

### Accurate Records Kept

Measurement of weight loss of samples, microscopic examinations and the like are made possible by the laboratory located at the site. Its technicians check each specimen, keep an accurate record of time exposure and location on racks, and carefully chronicle information on performance.

Sample specimens from the many studies are displayed in the marine museum. The equipment and apparatus installed at the Kure Beach project also include a wooden trough in three sections at three different levels, all connected, through which sea water from the basin is pumped constantly at a velocity of 3 fps. The combined length of the three sections is over 300 ft and the trough has a capacity for 1,000 specimens.

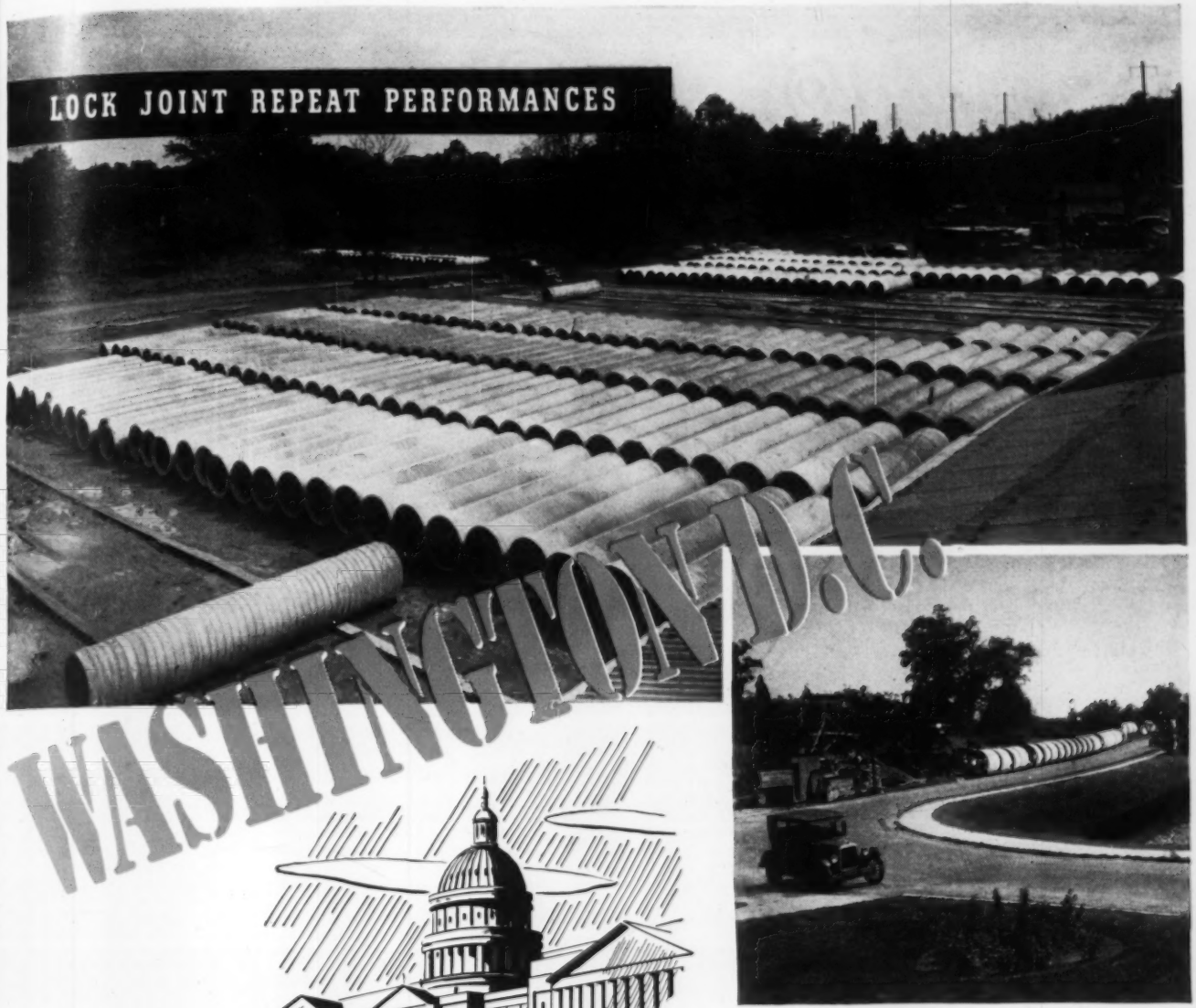



APPLIED ARCHITECTURAL ACOUSTICS. By M. Rettinger. Chemical Publishing Co., Brooklyn (N.Y.), 1947. 189 pp., illus., diagrs., charts, tables, 8¾×5½ in., cloth, $5.50. A practical book giving theoretical and functional uses of theory for the design of motion picture theaters, scoring stages, reverberation chambers, vocal rooms, sound stages, broadcasting and television studios, hospitals, churches and auditoriums. A separate chapter is devoted to acoustic measurements. It should be useful to architects, engineers and contractors.

THE CHEROKEE PROJECT. Tennessee Valley Authority, Knoxville (Tenn.), 1946. 411 pp., 138 illus., 9×6 in., cloth. May be purchased from the Superintendent of Documents, Washington, D.C., at $1.50 a copy. The present volume in the TVA's projected series on its great construction projects covers the planning, design, construction, and initial operations of the Cherokee Dam and Reservoir on the Holston River. Cherokee was the first of several TVA dams authorized under the World War II Emergency Program and constructed on an emergency basis. Although operated primarily for power ducing the war, it forms an integral unit in the over-all system of water-control projects in the Tennessee Valley.

ELEMENTARY FLUID MECHANICS. 2 ed. By J. K. Vennard. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 339 pp., illus., diagrs.,-charts, tables, 8¾×5½ in., cloth.

(*Continued on page 90*)






1925 (Above) – Installing pipe for first Lock Joint contract in Washington.

1944 (Top) – Lock Joint Prestressed Concrete Pipe at manufacturing plant – ready for installation in Washington, D. C.

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# APPLICATIONS FOR ADMISSION OR TRANSFER

October 1, 1947 Number 10

*The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.*

*Every Member is urged, therefore, to scan carefully the list of candidates published each month in* CIVIL ENGINEERING *and to furnish the Board with data which may aid it in determining the eligibility of any applicant.*

*It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board. Communications relating to applicants are considered strictly confidential.*

*The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.*

## MINIMUM REQUIREMENTS FOR ADMISSION

| GRADE | GENERAL REQUIREMENT | AGE | LENGTH OF ACTIVE PRACTICE | RESPONSIBLE CHARGE OF WORK |
|---|---|---|---|---|
| Member | Qualified to design as well as to direct important work | 35 years | 12 years | 5 years |
| Associate Member | Qualified to direct work | 27 years | 8 years | 1 year |
| Junior | Qualified for subprofessional work | 20 years | 4 years | |
| Affiliate | Qualified by scientific acquirements or practical experience to cooperate with engineers | 35 years | 12 years | 5 years |

## APPLYING FOR MEMBER

BANKS, WILLIAM FOSTER (Age 60) Director and Chairman of Board, Motor Haulage Co., Inc., Brooklyn, N.Y.

BROWN, FREDERICK RAYMOND (Assoc. M.) (Age 35) Engr. P-5, Waterways Experiment Station, Vicksburg, Miss.

COLE, HESTON RARICK (Age 52) Dist. Engr., Corps of Engrs., Duluth, Minn.

DABNEY, GORDON WILLEFORD (Age 44) Senior Engr. P-5 and Asst. Chf. of Roads, Runways and R.Rs. Branch, Hdq. 4th Army, Ft. Sam Houston, Tex.

DRAIN, RAY ALEXANDER (Age 41) Asst. Prof., Civ. Eng. Dept., Oklahoma A.&M. Coll., Stillwater, Okla.

DUDLEY, JOHN HENDERSON (Age 40) Executive Officer to Ground Engr., Hdq. Army Ground Forces, Ft. Monroe, Va.

FORTSON, EUGENE PALMER, JR. (Assoc. M.) (Age 40) Chf., Hydr. Div., Waterways Experiment Station, Vicksburg, Miss.

GARTHE, EDMUND CONRAD (Age 35) San Engr., Dist. Engr., USPHS, Chicago, Ill.

GOGGIN, JOHN PARKIN (Age 48) Cons. Engr., Municipal Highway, Drainage and Airport Consultants, Clare, Mich.

GORDON, BENNET TAYLOR (Assoc. M.) (Age 45) Engr. in charge of office, G. S. Richardson, Cons. Engr., Pittsburgh, Pa.

GREENBAUM, ERVIN (Assoc. M.) (Age 35) Pres. Empire Tractor Corporation, New York City; Detroit, Mich.

HANKS, EDMUND ELLIOTT (Age 58) Dist. Engr., American Inst. of Steel Constr., Inc., New York City; Greensboro (N.C.) Dist.

HOWARD, GEORGE WILBERFORCE (Assoc. M.) (Age 36) Prin. Engr., Chief, Test Sec., Yuma Test Branch Eng. Research & Development Laboratories, Yuma, Ariz.

KELLY, EARL MICHAEL (Assoc. M.) (Age 42) Vice-Pres., Process Engrs., Inc., Los Angeles, Calif.

KIRCHNER, ROBERT CARROLL (Age 49) Senior Engr., RFC, Pittsburgh, Pa.; Washington, D.C.

KOSH, DAVID ALPERIN (Jun.) (Age 35) Head, Public Utilities Div., Bureau of Federal Supply, Treasury Dept., Washington, D.C.

LATENSER, JOHN, JR. (Assoc. M.) (Age 59) Member of firm, John Latenser & Sons, Archts., Omaha, Nebr.

MANN, CARROLL LAMB, JR. (Assoc. M.) (Age 35) Partner, Mann & McLawhorn Engrs. & Archts., Greensboro, N.C.

MATTSON, RAGNAR JOHN (Age 53) Project Officer (Grade A), Central Technical Power Board, Govt. of India, Simla, India.

NIEDERHOFF, AUGUST EVAN (Assoc. M.) (Age 42) Civ. Eng. for Oinec, Naval Ordnance Test Station at Inyokern, Calif.

NIVAS, HARI KRISHNA (Age 42) Leader of Bridge Group, 2d Deputation of Indian Highway Engineers to America, Bihar, India.

OLISZEWSKI, CASIMIR (Assoc. M.) (Age 39), Lt Col., Corps of Engrs., Bn. Comdr., 42nd Engr Constr. Bn., Seoul, Korea.

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ROBINSON, ERNEST LEFFERT (Assoc. M.) (Age 57) Structural Engr., Turbine Generator Eng. Div., Gen. Elec. Co.; Schenectady, N.Y.

RODIONOV, ALEXANDER PETROVICH (Age 47) Archt., Chandler Cohegen, Billings, Mont.

STELGER, JOHN ALBERT (Jun.) (Age 37) Asst. Dist. Public Works Officer, U.S. Navy, San Juan, Puerto Rico.

WYNNE-EDWARDS, ROBERT MEREDYDD (Assoc. M.) (Age 50) Chf. Engr., Director Richard Costain, Ltd., London, England.

## APPLYING FOR ASSOCIATE MEMBER

ANDREASSEN, ALEXANDER TORLEIV (Jun.) (Age 31) Asst. Prof., Pennsylvania State Coll., State College, Pa.

BELL, FRANK MONTGOMERY (Age 34) Sec. Head, Soils Sec., South Atlantic Div., Corps of Engrs., Marietta, Ga.

BERG, MERLIN HANSON (Jun.) (Age 35) Head, Reports Sec. and Acting Asst. Chf. of Hydr. and Reports Branch, Dist. Engr.'s Office, Corps of Engrs., St. Paul, Minn.

BERGMAN, RAYMOND DAVID (Age 33) Constr. Engr., M. W. Kellogg Co., American Fork, Colo.

BETTLE, ALBERT FRANCIS (Age 37) Engr. Mgr., Hudspeth County Conservation & Reclamation Dist., Esperanza, Tex.

BHATIA, MANMOHAN SINGH (Age 30) Delegate of Central P.W.D. for Second Road Engrs. Delegation to U.S.A. from India Delhi Province, India.

BLESSEY, WALTER EMANUEL (Jun.) (Age 28) Associate Prof. of Bridge and Structural Eng., Dept. of Civ. Eng., Tulane Univ., New Orleans, La.

BONNEY, ROBERT MILTON (Age 29) Design Engr., Moffatt, Nichol & Taylor, Engrs., Portland, Ore.

BOWMAN, PAUL LESLIE (Age 48) Design Engr., Texas Highway Dept., El Paso, Tex.

BRULLMAN, AUGUST WILLIAM (Age 37) Project Supt., The Rust Eng. Co., Fernandina, Fla.

CAHILL, JOHN EDWARD (Jun.) (Age 32) Estimator & Office Mgr., Cahill Brothers, San Francisco, Calif.

CHANDLER, WILLIAM REEDER (Jun.) (Age 34) Gen. Supt., Trans-Arabian Pipe Line Co., San Francisco, Calif.

CHAUDOIN, DALLAS LESLIE (Age 33) Chf. Draftsman, San Diego Aqueduct, Vista, Calif.

CLARK, JOSEPH RALPH (Age 31) Graduate School of Eng., Harvard Univ., Cambridge, Mass.

COLLINS, JOHN GRIFFIN (Jun.) (Age 34) Supervisor with U.S. Geological Survey, Sacramento, Calif.

DOBERT, VINCENT JOSEPH (Jun.) (Age 34) Jun. Civ. Engr., New York State Dept. of Public Works, Buffalo, N.Y.

FLEISCHMAN, VOLNEY GEORGE (Jun.) (Age 34) Engr. P-2, U.S. Bureau of Reclamation, Boise, Idaho.

FOLEY, JOSEPH (Age 34) Engr., Mountain Water Supply Co., Philadelphia, Pa.; Camden, N.J.

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GINNER, CLIVE ERIC (Age 38) Supt., N. M. Ball Sons, Contrs., Berkeley, Calif.

GRIFFITHS, THOMAS WILLIAM (Jun.) (Age 34) Member of firm, Wilson & Griffiths, Los Angeles, Calif.

HAYES, THOMAS ALOYSIUS, JR. (Jun.) (Age 34) Civ. Engr., Frederick Snare Corp., Port Jefferson, N.Y.

HORNER, JAMES RUSSELL (Jun.) (Age 29) Engr., Structural Clay Products Institute, Washington, D.C.

HU, PAI CHUAN (Jun.) (Age 27) Tech. Expert, Public Works Bureau, Shanghai, China.

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KING, RALPH DICKSON (Age 33) Lt.-Col., Corps of Engrs., U.S. Army; Director, Waterways Experiment Station, Vicksburg, Miss.

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MACCHI, ANSELMO JOHN (Jun.) (Age 34) A. J. Macchi, Cons. Structural Engr., Hartford, Conn.

MCGILL, LLOYD HOWARD REISLER (Age 29) Chf. Engr., Rust Eng. Co., Kraft Pulp Mill, Berlin, N.H.

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MEIJER, LAMBERTUS (Age 33) Dist. Engr., Railway New Works, South African Rys., Johannesburg, South Africa.

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RANTZ, SAUL EDWARD (Age 36) Asst. Hydr. Engr., U.S. Geological Survey, Tacoma, Wash.

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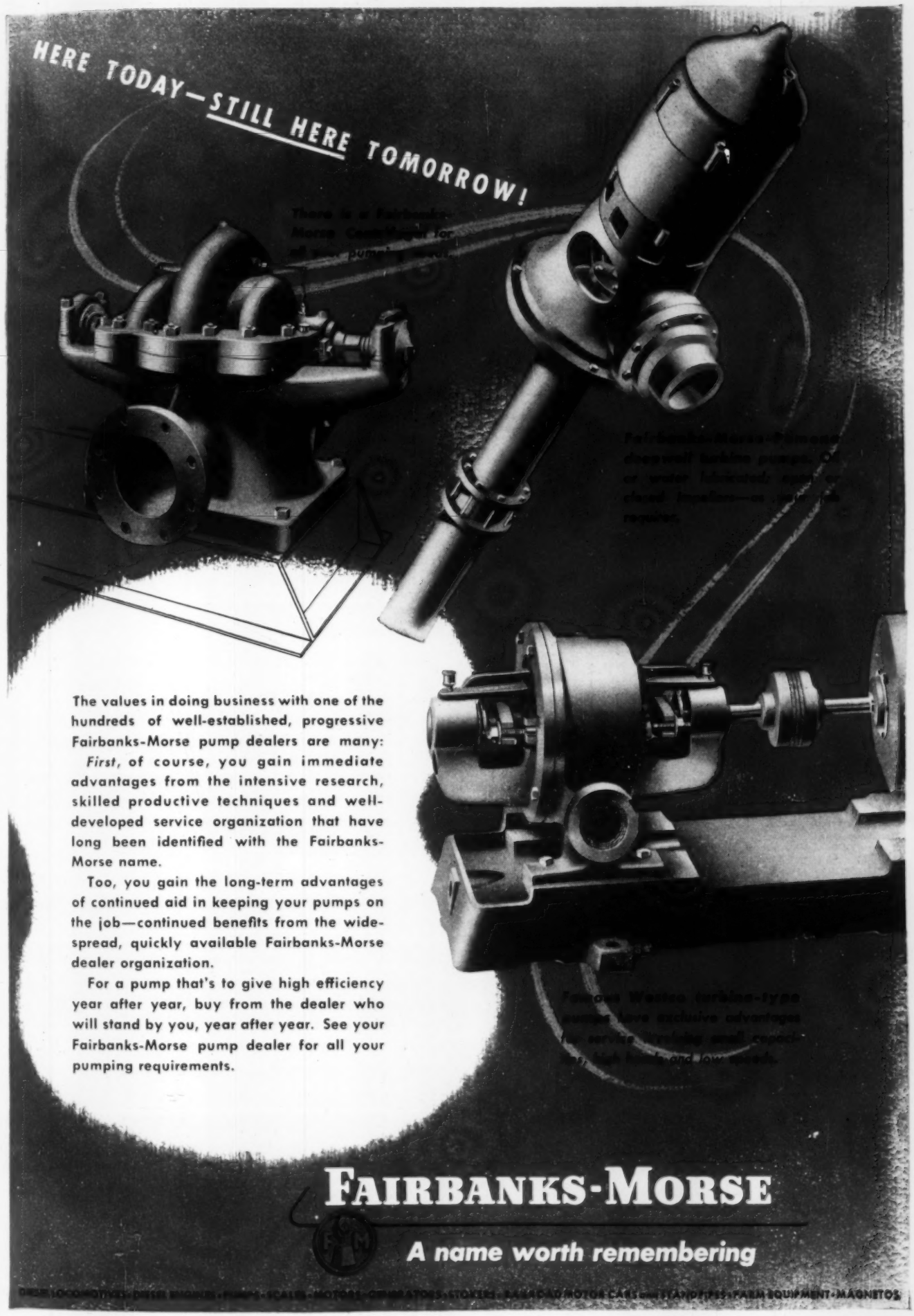


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SHAPLAND, JOHN SOMER (Age 28) Lt. Col., Corps of Engrs., U.S. Army; graduate student, Univ. of Illinois, Urbana, Ill.

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STEVENSON, ALBERT HENRY (Jun.) (Age 33) Major, San. Engr., Public Health Service, New York, N.Y.

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WAKE, BERT T. (Age 35) Designing Engr., Market Development Div., Carnegie-Illinois Steel Corp., Coraopolis, Pa.

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WILLIAMS, LESTER GEORGE (Age 33) Engr. P-3, U.S. Bureau of Reclamation, Monte Vista, Colo.

WILSON, PAUL ALBERT (Age 46) Eng. Chf., U.S. Engr. Office, Alouquerque, N. Mex.

YUZNA, SYLVESTER STEVE (Age 29) Highway Engr., U.S. PRA, Managua, Nicaragua.

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BUEHRIG, JOHN ELMO (Age 32) Civ. Engr., Humble Oil & Refining Co., Kingsville, Tex.

GAMALERO, MARIO WILLIAM (Age 24) Asst. Constr. Engr. P-3, Civil Service Comm., The Inst. of Inter-American Affairs, Guatemala City, Guatemala.

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NICHOLS, WILLIAM MAX (Age 25) Jun. Highway Engr., (PRA, Austin, Tex.

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REESE, RICHARD ELLSWORTH (Age 29) Engr., Bethlehem Steel Co., Baltimore, Md.

THOMAS, ARTHUR HENRY (Age 28) Eng. Draftsman, Arkansas Map Co., Little Rock, Ark.

VANDERWORTH, OSCAR DAVIS (Age 24) Structural Steel Detailer, Mosher Steel Co., Dallas, Tex.

### ALA. POL. INST.

| | Age |
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| CURTIS, JAMES KEITH, 1947 | (25) |
| FOUNTAIN, FOSTER FEAGIN, JR., 1947 | (26) |

### UNIV. OF ARK

| | |
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| NEAL, JAMES QUINTIN, 1947 | (28) |

### BROOKLYN POL. INST.

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|---|---|
| CRACHI, DOMENICO, JR., 1947 | (26) |
| GERSTENZANG, NORMAN PAUL, 1947 | (25) |
| RESNICOW, HERBERT, 1947 | (26) |
| SHEEHAN, RICHARD H., 1947 | (26) |

### CALIF. INST. TECH.

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|---|---|
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| EGGENBERGER, BYRNE, 1947 | (26) |
| HATCHER, DAVID SHERIDAN, 1947 | (28) |
| PRENDERGAST, JOHN PATRICK, 1947 | (24) |
| RAY, KAMALESH, 1947 | (33) |
| WIMBERLY, CLIFFORD MCBRIDE, 1947 | (26) |

### UNIV. OF CALIF.

| | |
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| ALDEN, DONALD WAYNE, 1947 | (24) |
| ALSTON, ANTHONY AUGUSTINE, 1947 | (24) |
| AUCHARD, PHILIP DONALD, 1947 | (26) |
| BALES, CLIFFORD SHIRLEY, 1947 | (25) |
| BELL, GEORGE EDWIN, 1947 | (26) |
| BERGSON, MILTON, 1947 | (23) |
| BETTINGER, RICHARD VISSING, 1947 | (25) |
| BIRD, MERRILL WHITING, JR., 1947 | (24) |
| BONDERSON, PAUL RICHARD, 1947 | (28) |
| BURNS, THOMAS JOSEPH, 1947 | (26) |
| CARLSON, DONALD EMIL, 1947 | (24) |
| CARLSON, DOUGLAS EDWARD, 1947 | (22) |
| CORREA, FRED BARRINGTON, JR., 1947 | (26) |
| COUTCHIÉ, ALLEN BENJAMIN, 1947 | (27) |
| DEMAREST, GARRETT WILLIAM, 1947 | (21) |
| EDMONSTON, ROBERT MCCOMBIE, 1947 | (22) |
| ELLIOTT, HUGH MACPHERSON, 1947 | (21) |
| ELLIOTT, ORA ELMER, JR., 1947 | (25) |
| FIELD, THOMAS MICHAEL, 1947 | (24) |
| FISHER, RAYMOND WILLIAM, JR., 1947 | (29) |
| FOLLETT, WESTON EUGENE, 1947 | (29) |
| FORTIER, SAMUEL COLLINS, 1947 | (26) |
| GEORGE, BEN, 1947 | (21) |
| GIDLUND, ALETTA WOOD, 1947 | (23) |
| GO, KONG HOY, 1947 | (25) |
| GREENAWALT, ROBERT OLIVER, 1947 | (26) |
| GREENE, KENNETH EDWARD, 1947 | (24) |
| GRESCHNER, WILLIAM DENTON, 1947 | (30) |
| GRIFFIN, ROGER LESLIE, 1947 | (24) |
| HANSEN, NORMAN BERNHARD, 1947 | (24) |
| HOLMES, CLARK, 1947 | (33) |
| JONES, WALTER PAUL, 1947 | (28) |
| KAM, EDWARD YEE KWONG, 1947 | (29) |
| KORSKO, ALBERT JOSEPH, 1947 | (24) |
| KROOSKOS, WILLIAM STEVE, 1947 | (23) |
| KRUSE, EDWARD HERMAN, 1947 | (23) |
| LAMON, LONNIE GRADY, 1947 | (26) |
| LANGE, FRED, JR., 1947 | (22) |
| LINDSKOG, EDWARD, 1947 | (24) |
| LOUIE, JIM VAN, 1947 | (26) |
| MCCARTY, JAMES EUGENE, JR., 1947 | (25) |
| MCCULLOUGH, ROBERT MARION, 1947 | (23) |
| MANCARTI, GUY DONALD, 1947 | (24) |
| MARKS, ROBERT, 1947 | (22) |
| MARTIN, LEROY, 1947 | (25) |
| MILLER, GORDON RALPH, 1947 | (25) |
| MORFORD, ANDERSON LEROY, 1947 | (24) |
| NIELSEN, ELMAN FREDERIC, 1947 | (21) |
| OSTROM, JOHN AVARD, 1947 | (21) |
| PERRICH, ROBERT JOHNSON, 1947 | (25) |
| PIERSALL, JACK RAY, 1947 | (24) |
| RAHLVES, LOUIS GLANDER, 1947 | (27) |
| RASMUSSEN, JAMES ROBERT, 1947 | (28) |
| RING, ALLEN DALE, 1947 | (25) |
| SCHWARTZ, MILTON, 1947 | (27) |
| SHOWER, HAZEN WILLIAMS, 1947 | (25) |
| STAUBER, ARTHUR DOUGLAS, 1947 | (21) |
| STEELE, FLETCHER HAIGHT, 1947 | (27) |
| STEGER, DONALD BURRELL, 1947 | (29) |
| STEWART, FARREL ARTHUR, 1947 | (25) |
| STONE, RAYMOND VANBUREN, JR., 1947 | (26) |
| UNGER, CHARLES WYATT, 1947 | (22) |
| WALLEN, MARTIN ALBERT, 1947 | (22) |
| WESTFALL, RODNEY DUANE, 1947 | (22) |
| WHITE, FRANK TRUMBULL, 1947 | (23) |
| WICKHAM, GEORGE EDDY, 1947 | (26) |
| WILDMAN, ROBERT FRANCIS, 1947 | (25) |
| WILLIAMS, GEORGE ALEXANDER, JR., 1947 | (25) |
| YEAGER, JACQUES STALDER, 1947 | (24) |
| ZANE, ALBERT CHONG-FOOK, 1947 | (28) |

### CASE SCHOOL OF APPLIED SCI.

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| FARMER, WILLIAM BENNETT, 1947 | (22) |
| HUNT, ROBERT CHESTER, 1947 | (24) |
| RUFF, PAUL FULTON, 1947 | (23) |
| SATROM, LEROY MARTIN, 1947 | (28) |

### UNIV. OF CIN.

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| GRISSETT, FINLEY MCCORVEY, JR., 1947 | (26) |
| THOMSEN, CARL LEROY, 1946 | (26) |

### THE CITADEL

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| FISCHER, GEORGE HERMAN, JR., 1947 | (25) |

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| LIKINS, SAMUEL SMETTERS, 1947 | (25) |

### UNIV. OF CONN.

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|---|---|
| AISAWA, SHIRO, 1947 | (23) |
| GROW, THOMAS AUGUSTUS, 1947 | (26) |
| KOVACS, EUGENE, 1947 | (33) |

### CORNELL UNIV.

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|---|---|
| TOMASETTI, RAYMOND EMIDIO, 1947 | (26) |

### DARTMOUTH COLL.

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|---|---|
| FIELD, DELBERT HAFF, 1947 | (25) |

### UNIV. OF DETROIT

| | |
|---|---|
| HOSTEN, EMMA ELISE, 1947 | (22) |

### DREXEL INST. TECH.

| | |
|---|---|
| BERMAN, MANUEL, 1947 | (26) |
| BINTZER, WILLIAM WINFIELD, 1947 | (26) |
| DEANGELO, JOSEPH ANTHONY, 1947 | (25) |
| HAASE, WILLIAM PIERRE, 1947 | (24) |
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| LOVETT, ORVAL PUSEY, JR., 1947 | (27) |
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| TAKEDA, TSURUZO, 1947 | (25) |

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| | |
|---|---|
| DADY, EDMUND THOMAS, 1947 | (29) |

### GA. SCHOOL OF TECH.

| | |
|---|---|
| BURKE, GEORGE WALTER, JR., 1947 | (28) |
| CLARSON, RICHARD PATREUS, 1947 | (22) |
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| WEISHAUPT, THOMAS JOHN, 1947 | (32) |

### HARVARD UNIV.

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|---|---|
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| PECKOVER, FREDERICK LIONEL, 1947 | (25) |
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| | (27) |

### IOWA STATE COLL.

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|---|---|
| KOENIG, HAROLD PAUL, 1947 | (21) |

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| BUCHWALTER, RICHARD LEE, 1947 | (26) |

### JOHNS HOPKINS UNIV.

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|---|---|
| ANDRIOTIS, THEODORE MICHAEL, 1947 | (23) |
| LYON, WALTER ALPHONS, 1947 | (23) |
| PROSSER, JOSEPH LAWRENCE, 1947 | (24) |

### KANSAS STATE COLL.

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|---|---|
| DILDINE, EVAN DAVIS, 1947 | (27) |
| GUDER, CLYDE RAY, 1947 | (25) |

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| | |
|---|---|
| JACKSON, RALPH ANDREW, 1947 | (25) |
| LONGAN, FRANCIS EDWIN, 1947 | (33) |
| RUSKIN, JOHN HOWARD, 1947 | (26) |

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| TITLOW, WALTER STOCKTON, JR., 1947 | (26) |

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| BESSEN, SEYMOUR, 1947 | (24) |
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| FLUME, GEORGE ALBERT, 1947 | (21) |
| KING, MARTIN, 1947 | (24) |
| MARTIN, JOHN GILBERT GERARD, 1947 | (24) |
| MEYER, MORTIMER WASHINGTON, JR., 1947 | (25) |
| REDDERSEN, JOHN KERNACHAN, 1947 | (23) |

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| MOORE, WILLIAM CURTIS, JR., 1947 | (30) |

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|---|---|
| BROWN, EUGENE THOMAS, 1947 | (25) |
| DODD, DONALD NAISMITH, 1947 | (24) |
| MCKEE, GEORGE MOFFITT, JR., 1947 | (23) |
| POLEDOR, ANDREW PENDEL, 1947 | (20) |
| VALDES PINILLA, MARIO RAUL, 1947 | (26) |
| WESTA, GILBERT MARIUS, 1947 | (23) |

### UNIV. OF MINN.

| | |
|---|---|
| DEDOLPH, KARL, JR., 1947 | (27) |
| JOHNSON, ARCHIE HYTTSTEN, 1947 | (24) |
| ROSENGREN, EARL VINCENT, 1947 | (24) |

### MO. SCHOOL MINES

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|---|---|
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| LAHMEYER, RAYMOND HERMAN, 1947 | (28) |

### UNIV. OF N.H.

| | |
|---|---|
| BROWN, HOWARD HALE, 1947 | (24) |
| STUART, DAVID GEORGE, 1947 | (25) |

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| LANGLEY, GEORGE EDWARD, 1947 | (26) |

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| | |
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| JOHNSON, STANLEY SMITH, 1947 | (31) |

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| IGEL, GEORGE JOSEPH, JR., 1947 | (23) |

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| BELLUCCI, ORPHEUS ROBERT, 1947 | (23) |

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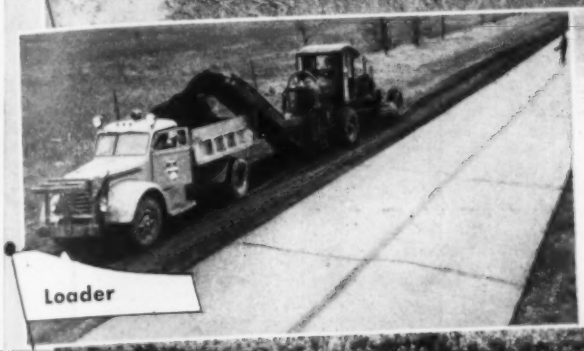

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HAACKE, ROLAND ERNST, 1947 (24)

RICE INST.

GARRETT, WILLIAM RILEY, JR., 1947 (22)

UNIV. OF SANTA CLARA

BRYON, ALVARO, 1947 (27)

UNIV. OF S.CALIF.

ERICKSON, JOHN ALFRED, 1947 (25)
JAMES, ROBERT EARL, 1947 (29)
LEE, WALTER BEN, 1947 (24)
MURRAY, WILLIAM BRUCE, 1947 (26)

S.DAK. STATE COLL.

BUCKLEY, ERNEST LYNN, 1947 (23)

STANFORD UNIV.

BARTLE, RICHARD MILNE, 1947 (22)

SWARTHMORE COLL.

DE BURLO, COMEGYS RUSSELL, JR., 1947 (23)

UNIV. OF TENN.

ENGLISH, WILLIAM ALEXANDER, 1947 (23)
FINCANNON, SAM LAFAYETTE, JR., 1947 (27)

A.&M. COLL. OF TEX.

BAKER, FREDERICK JOHN, 1947 (29)
BALL, HENRY FLETCHER, JR., 1947 (25)
BARDGETTE, JOHN JOSEPH, 1947 (24)
BLANKINSHIP, BENJAMIN THOMAS, 1947 (23)
CAMPBELL, ARTHUR WALLACE, JR., 1947 (23)
CARNEY, HAROLD POWELL, JR., 1947 (28)
FAUST, EDMOND LAWRENCE, JR., 1947 (26)
FEAGAN, GEORGE HAROLD, 1947 (28)
FORAN, WILLIAM JAMES, 1947 (28)
GRANT, JOHN ALEXANDER, JR., 1947 (24)
HAYNES, HAROLD JEAN, 1947 (22)
HEATH, GLENN RENICK, JR., 1947 (24)
KINCY, WILLIAM PERRY, JR., 1947 (25)
LACKEY, GERALD GLYNN, 1947 (26)
NEWMAN, VIRGIL PALMER, 1947 (23)
SCHUMANN, MAX ALBERT, JR., 1947 (24)
SEAY, ROBERT LINCOLN, JR., 1947 (25)
STANLEY, EDWIN JAMES, 1947 (24)
STORK, OLIVER FRED, 1947 (23)
STUBBS, SCOTT GAMBLE, 1947 (27)
WAGGENER, WILLIAM GARNETT, 1947 (24)

UNIV. OF TEX.

HOFMANN, THOMAS GEORGE, 1947 (24)

TOLEDO UNIV.

PARR, THEODORE SCOTT, 1947 (23)

TUFTS COLL.

OLDHAM, CHARLES EDWARD, 1947 (20)
SCHMIDT, JOSEPH, 1947 (24)
WARD, KENNETH FOSTER, 1947 (23)

UNION COLL.

GOLDREICH, JOSEPH DANIEL, 1945 (21)

UTAH STATE AGRI. COLL.

CHRISTENSEN, RULON C., 1947 (24)
OLAFSON, ELLAF ARNI, 1947 (31)
WOODWARD, KENNETH LOWE, 1947 (24)

UNIV. OF UTAH

SOMPS, GEORGE EDWARD, 1947 (23)

VANDERBILT UNIV.

SUMNER, BILLY TAYLOR, 1946 (24)

VA. MIL. INST.

CLARK, WAYNE GORDON, JR., 1947 (26)

VA. POL. INST.

BISHOP, ROY PRENTISS, JR., 1947 (24)
DUNAVANT, PRESTON PAYNE, JR., 1947 (25)
HAYMAKER, WILLIAM JACKSON, 1947 (22)
WILLIAMS, JACK ALFRED, 1947 (24)

STATE COLL. OF WASH.

ROOT, MAURICE DOUGLAS, 1947 (24)

UNIV. OF WASH.

AUSTIN, JAMES RICHARD, 1947 (22)
BLECKEN, WILLIAM ELLETT, 1947 (24)
BRADFORD, WILLIAM EDGAR, 1947 (25)
BUNCH, WILLIAM CLAXTON, 1947 (26)
CHAFFEE, JOHN LYMAN, 1947 (24)
COOLEY, RICHARD PATTISON, 1947 (26)
DEGRACE, ROBERT FOREST, 1947 (26)
GILLESPIE, WILLIAM BRADWIN, 1947 (25)
HADLEY, RICHARD HOMER, 1947 (26)
HOY, JAMES MILLER, 1947 (29)
JACKSON, RICHARD VERNON, 1947 (25)
KLEIKAMP, JOSEPH LEO, 1947 (27)
KONZEN, ALLAN SYLVESTER, 1947 (21)
LAVERTY, BRUCE ROSS, 1947 (20)
MAGNUSSON, ROBERT SKULI, 1947 (24)
MASON, HAROLD GEORGE, 1947 (22)
MUELLER, ROBERT FULTON, 1947 (26)
OSTROM, DONALD DUANE, 1947 (24)
QUADE, HENRY FRED, 1947 (21)
WILLARD, HARRY GAYLORD, 1947 (27)

WASH. UNIV.

DONNELL, ROBERT JAMES, 1947
PETERSEN, EUGENE JOSEPH, JR., 1947 (24) (21)

WAYNE UNIV.

CAMPBELL, KENNETH ALEXANDER, 1947 (25)
KRELL, WILLIAM CHARLES, 1947 (26)
SIGETICH, MILAN GEORGE, 1947 (29)

W.VA. UNIV.

LAYMAN, CARL MIDDLETON, JR., 1947 (23)
MITCHELL, RICHARD JACKSON, 1947 (27)
ROBINSON, ROBERT WILSON, 1947 (26)

UNIV. OF WIS.

GLENN, ALFRED HILL, 1947 (26)

WORCESTER POL. INST.

BIAMON, JOSE RAFAEL, 1947 (22)

UNIV. OF WYOMING

DOERR, JOHN L., 1947 (31)
JOBE, JOHN THOMAS, JR., 1947 (27)
JONES, ROBERT CLINTON, 1947 (24)
MCNINCH, KEITH E., 1947 (25)
NELSON, THURLOW CHRISTIAN, JR., 1947 (25)
WAGNER, WILLIAM, 1947 (25)
WEBER, JOHN GAYLORD, 1947 (23)

YALE UNIV.

LAVELLE, FRANCIS HAROLD, 1947 (21)

*The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.*

# CHANGES IN MEMBERSHIP GRADES

## ADDITIONS, TRANSFERS, REINSTATEMENTS, AND RESIGNATIONS

**From August 10 to September 9, 1947**

### Additions to Membership

ANDERSON, NORMAN WILLIAM (Assoc. M. '47) Senior Engr., County Sanitation Districts of Los Angeles County, 1206 Maple Ave., Los Angeles 15, Calif.

ANDREWS, LOUIS CULLEN (Assoc. M. '47) (L. C. Andrews Steel Products), P.O. Box 7126 (Res., 2707 Acacia St.), New Orleans 17, La.

APPLEGATE, JULIAN EUGENE (Assoc. M. '47) Senior Highway Engr., U.S. Public Roads Administration, 515 Forum Bldg., Sacramento 14, Calif.

ASROW, SHERWIN PRESTON (Jun. '47) Structural Engr., Shaw, Naess & Murphy, 80 East Jackson Blvd. (Res., 4540 Drexel Blvd.), Chicago, Ill.

ATKINSON, ROBERT MOUNT (Assoc. M. '47) (E. S. & Robert M. Atkinson), P.O. Box 4093 (Res., 3020 Carnegie), Houston, Tex.

BARNES, JACK RICH (Jun. '47) Hydr. Engr., Ground Water Div., U.S. Geological Survey, Plainview, Tex.

BEATTY, FRED K. (Jun. '47) Structural Designer & Detailer, Black & Veatch, Cons. Engrs., 4706 Broadway (Res., Box 8181, Plaza Station), Kansas City, Mo.

BECKER, ALAN ARTHUR (Jun. '47) Instr. of Civ. Engr., Missouri School of Mines, Rolla, Mo.

BEEBE, GEORGE CLIFTON (Jun. '47) Field Engr., Mason & Cullen Builders, 6326 Market St., Philadelphia (Res., 210 Garrett Ave., Swarthmore), Pa.

BERG, GLEN VIRGIL (Assoc. M. '47) Engr., The Panama Canal, Balboa Heights (Res., P.O. Box 845, Diablo Heights), Canal Zone.

BIEHN, FLORENCE OLEN (Assoc. M. '47) (R. Stuart Royer and Associates), 207 Exchange Bldg. (Res., 2424 Kenmore Rd.), Richmond, Va.

BJORK, JOHN HERBERT (Assoc. M. '47) Constr. Engr., U.S. Bureau of Reclamation, Coachella, Calif.

BOGGIS, LEO VICTOR (Jun. '47) Civ. Engr., The Foundation Co., 57 William St., New York, N.Y. (Res., 21 Concord St., Jersey City, N.J.)

BOHNER, ARTHUR WILLIAM (M. '47) Constr. Engr., State of Nebraska, Dept. of Roads and Irrigation, State Capitol (Res., 1641 South 26th), Lincoln, Nebr.

BOOTH, CLAUDE CARR (Jun. '47) Junior Civ. Engr., Gulf Oil Corp., 30th & Penrose Ave. (Res., 2555 South Dewey St.), Philadelphia 42, Pa.

BOYD, WILLIAM KEITH (M. '47) Chf., Flexible Pavement Branch, U.S. Waterways Experiment Station, Box 631, Vicksburg, Miss.

BRADSHAW, ODELL BORGSTROM (Jun. '47) Asst. City Engr., City of Lima, City Hall, Lima, Ohio.

BRASHEARS, MAURICE LYMAN, JR. (Affiliate '47) District Geologist, U.S. Geological Survey, Room 226, P.O. Bldg., Jamaica (Res., 145 Meadow St., Garden City), N.Y.

BRETT, JOHN EDWARD (Jun. '47) Cons. Engr., 7465 St. Aubin, Montreal 16, Canada.

BRIGGS, LEROY FRANK (Jun. '47) Teacher in Civ. Eng., San Francisco Junior College; 1834 Laguna St., Santa Barbara, Calif.

BUDD, WILLIAM EDWARD (Jun. '47) Field Engr., State Highway Dept., Montague (Res., 402 West Pecan, Bowie), Tex.

BURNHAM, ROGER HARRY (Jun. '47) Safety Engr., Standard Oil Co. of New Jersey, Box 16 (Res., 477 Westminster Ave.), Elizabeth, N.J.

CALLAHAN, DEAN TAYLOR (Jun. '47) 14901 Lorain Ave., Cleveland 11, Ohio.

CARBALLEIRA, ROBERT JOSEPH (Assoc. M. '47) Asst. Chf. Engr., Instituto Nacional Obras de Sanitarias, Nuevas Obras Del Acueducto de Caracas, Edificio Manhattan, Esquina Cuj Caracas, Venezuela.

CARTIER, MORGAN EDWARD, JR. (Jun. '47) Student Notre Dame Univ., Notre Dame, Ind. (Res. 300 Morris Ave., South East, Grand Rapids Mich.)

CHAPMAN, PHILIP STANARD (Assoc. M. '47) Civ Engr., Corps of Engrs. U.S. Army, Okinawa Engrs., Okinawa Engr. Dist., Army Post Office 331, Care Postmaster, San Francisco, Calif.

CHENEY, MILFORD MORRIS (Jun. '47) Asst. Plant Engr., Indiana Bell Telephone Co. (Res., 4808 Central Ave.), Indianapolis 5, Ind.

CHU, KUANG HAN (Jun. '47) 504 Delaware St., Urbana, Ill.

COLLINS, CECIL FRANKLIN (Assoc. M. '47) Foundation Engr., Donald R. Warren Co., 500 South Figueroa, Los Angeles (Res., 2222 Westboro Ave., Alhambra), Calif.

COOKE, WILLIAM ROBERT (Jun. '47) Civ. Engr., Dept. of Aeronautics, State of Ill., 503 South Seventh St. (Res., 1605 Dial Court), Springfield, Ill.

COOLEY, JOHN MELVIN (Jun. '47) Engr., P.R. Alaska Road Comm. (Res., Box 608), Fairbanks, Alaska.

# USERS REPORT ON THE "CATERPILLAR" BULLDOZER!

**IT'S A HIT!** NO ADDITION TO THE "CATERPILLAR" LINE HAS WON HIGHER PRAISE THAN THE NEW "CATERPILLAR" BULLDOZER. HERE ARE A FEW SAMPLES OF THE WAY USERS FEEL ABOUT IT:

**From Walter O'Neill, contractor, Havre, Montana**

"Unquestionably it's the best and last word in 'dozers. The ability to tilt the blade enables doing lots of work that would previously have required an angledozer. We moved 9000 cubic yards in 5 days this past week. This 'dozer beats any we know of."

**From Harry Sandora, D7 operator, Conn.**

"With the D7 and the 'Caterpillar' Bulldozer blade I can walk these 2-foot stumps right out of the ground."

**From S. T. Lambeth, Greensboro, N. C.**

"Best darn 'dozer I've ever owned or seen operated. Visibility is perfect; blade extremely rugged and durable; dirt seems to roll from the blade instead of sticking to it; blade reacts very quickly to the controls and it will dig harder material than any other 'dozer of comparable size on the market."

**From John Gaston, Main Roads Commission, Queensland, Australia**

"I think the 'Caterpillar' 'dozer is the best and most easily controlled of any I have handled. Driving a D7 with 'Caterpillar' 'dozer attached, I loaded 1980 yards of earth in 8½ hours."

**From N. M. Whilden, contractor, Dallas, Texas**

"I've made no adjustments to this unit in 3 months, where formerly on other equipment adjustment was necessary every day."

**From Jim Calas, farm contracto.. Lakeview, Oregon**

"Since running it a month, am more glad than eve. I waited. It does everything a fellow could ask. The 'dozer handles nice and easy and accurate."

**From R. H. Byles, lumberman, Fresno, Calif.**

"This outfit is rugged. It's the best dirt-moving 'dozer I've seen."

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL

ENGINES • TRACTORS

MOTOR GRADERS

EARTHMOVING EQUIPMENT

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

CRAVEN, MONTAGUE ASSHETON (Assoc. M. '47) Branch Mgr., Certified Concrete Ltd., P.O. Box 95, Lower Hutt (Res., 78 Hatton St., Karori, Wellington W.3), New Zealand.

CUNDALL, KENNETH NEWTON (Assoc. M. '47) Mgr., Laykold Sales, American Bitumuls Co., 200 Bush St., San Francisco (Res., 2435 Otis Drive, Alameda), Calif.

DE LABORDE, CARLOS MUNOZ (Assoc. M. '47) Ingeniero Director Grupo de Puertos Ibiza, Ministerio Obras Publicas, Baleares (Res., San Fernando 44, Alicante), Spain.

DELANO, CHARLES FISHER, JR. (Jun. '47) Junior Engr., Black & Veatch, Cons. Engrs., 4706 Broadway, Kansas City (Res., 420 East 14th St., Hutchison), Kans.

DENNEY, J. C. (Jun. '47) Civ. Engr., Humble Oil & Refining Co., Box 672, Kingsville, Tex.

DODSON, LEWIS (Assoc. M. '47) Director of Environmental Sanitation, Denver City-County Health Dept., Denver Gen. Hospital, Denver, Colo. (Res., 1402 Washington Heights, Ann Arbor, Mich.)

DOW, ARTHUR LESTER (M. '47) City Mgr. and Supt. of Board, Public Utilities, City of Paris, Utilities Bldg. (Res., P.O. Box 291), Paris, Tenn.

DUKLETH, ERNEST ALFRED (Jun. '47) Engr.'s Aide, SP-5, U.S. Bureau of Reclamation, Hungry Horse Project, Coram (Res., 304 Dakota Ave., Whitefish), Mont.

DUNN, ELMER NEWTON (Assoc. M. '47) Project Engr., State Highway Comm., Plentywood (Res., 830 Fourth Ave., West, Kalispell), Mont.

EASTERLY, HARRY WATKEY, JR. (Jun. '47) Constr. Engr., Concrete Pipe & Products Co., Inc., Box 1223, Richmond, Va.

ELLETT, TAZEWELL, III (Jun. '47) Engr. Asst., Sunnyside Granite Co., Belt Leni at Cary St. (Res., 1003 Grove Ave.), Richmond, Va.

EL-SAMNY, EL-SAYED AHMED (Jun. '47) Lecturer, Faculty of Eng., Fouad 1st Univ., Giza, Egypt; Univ. of Calif. (Res., International House), Berkeley 4, Calif.

ERHART, ERIC EARL (Assoc. M. '47) Highway Engr., U.S. Public Roads Administration, 720 Phelan Bldg. (Res., 744 Twenty-fourth Ave.), San Francisco 21, Calif.

EVANS, WILLIFORD JAMES (Jun. '47) Coordinator of Eng. Education, College of Eng., Louisiana State Univ., Baton Rouge (Res., Elizabeth), La.

EYBERG, QUENTIN CHARLES (Jun. '47) Field Engr., M. W. Kellogg Co., 5300 Holabird Ave. (Res., 2723 North Howard St.), Baltimore 18, Md.

FEAGIN ARTHUR HENRY (Assoc. M. '47) Maj., C.E., U.S. Army U.S. Engr. Office, Mobile (Res., 198 North Border Drive, Spring Hill), Ala.

FOOTE, ROBERT LAWRENCE (Jun. '47) Student, 414 Forty-eighth St., Brooklyn 20, N.Y.

FORD, JAMES BENNETT (Assoc. M. '47) Bldg. Inspector, City of Lynchburg, 208 City Hall (Res., 327 Buena Vista St.), Lynchburg, Va.

FORTUNATO, STEVEN LOUIS (Jun. '47) Asst. to Bldg. Contr., Luigi Fortunato, 301 West 37th St., Wilmington, Del.

FOX, THOMAS ANDREW, JR. (Jun. '47) Asst. Engr., Akron, Canton & Youngstown, R.R., 12 East Exchange St. (Res., 1282 Neptune Ave.), Akron 1, Ohio.

FREDERICK, WILLIAM LAWRENCE (Assoc. M. '47) Highway Field Engr., Public Roads Administration, Box 1269, Madison (Res., Box 47, Brooklyn), Wis.

FREDIN, JOHN FREDERICK (Assoc. M. '47) Civ. Engr., City of Duluth, City Hall, Duluth, Minn.

FRITZ, EDUARD, JR. (M. '47) Care, Pennsylvania Water & Power Co., 1611 Lexington Bldg. (Res., 215 Cedarcraft Road), Baltimore 12, Md.

FROEBERG, KENNETH ERLAND (Jun. '47) Engr., George B. H. Macomber Co., 19 Milk St., Boston (Res., 1294 Main St., Brockton), Mass.

FRUCHET, PIERRE AIME (Jun. '47) Field Engr., 7 Rue Claude Matrat, Issy-Les-Moulineaux, Seine, France.

GATES, VERNE WILLIAM (Assoc. M. '47) Associate Engr., Corps of Engrs., War Dept., 74 New Montgomery St., San Francisco (Res., 489 West MacArthur Blvd., Oakland 9), Calif.

GERDIN, HAROLD EUGENE (Jun. '47) Asst. Engr., Standard Oil Co. of California, P.O. Box 3647 (Res., 1548 West Vernon Ave.), Phoenix, Ariz.

GETTER, GUSTAV (Jun. '47) Junior Civ. Engr., New York City Housing Authority, 122 East 42nd St., New York (Res., 1031 Montgomery St., Brooklyn 13), N.Y.

GILMORE, ROBERT ALLEN (M. '47) Project Engr., J. E. Greiner Co., 1201 St. Paul St., Baltimore (Res., Box 189, R.F.D. 7, Pikesville 8), Md.

GILTNER, LOU WALLACE (Assoc. M. '47) Civ. Engr., P-4, Naval Air Station, Kaneoke, Oahu (Res., 2125 Lanihuli Drive, Honolulu), Hawaii.

GRAY, WALTER BARRY (M. '47) Chf. Structural Engr., Holabird & Root, Archts. and Engrs., 180 North Wabash Ave., Chicago 1, Ill.

## TOTAL MEMBERSHIP AS OF SEPTEMBER 9, 1947

| | |
|---|---|
| Members | 6,739 |
| Associate Members | 8,786 |
| Corporate Members | 15,525 |
| Honorary Members | 38 |
| Juniors | 6,519 |
| Affiliates | 76 |
| Fellows | 1 |
| Total | 22,159 |
| (September 9, 1946 | 21,572) |

GREGORY, ROBERT ELMO (Assoc. M. '47) Associate Engr., Civ. Eng. Dept., Arkansas Natural Gas Corp., P.O. Box 1734 (Res., 1107 Rendall St.), Shreveport 36, La.

GRIFFEN, EARLE (M. '47) Asst. City Engr., City of Yonkers, City Hall, Yonkers 2, N.Y.

GUMERSON, WILLIAM DOW (Assoc. M. '47) Archt., E. I. du Pont de Nemours, Wilmington, Del. (Res., 250 East Main, Elkton, Md.)

HAMERSLY, JAMES WILLIAM (Jun. '47) Supt., R. P. Farnsworth & Co., 3018 Leeland (Res., 10 West Lane,) Houston 6, Tex.

HARDY, ROLLAND LEE (Jun. '47) Topographic Engr., P-1, Central Div., U.S. Geological Survey, Box 133, Rolla, Mo. (Res., Carthage, Ill.)

HEATHERLY, JOE EDWIN (Jun. '47) Hydr. Engr., U.S. Geological Survey, 411 Grand Theatre Bldg., Atlanta (Res., 413 Gramling St., Marietta), Ga.

HENDERSON, FRED ROBERT (Assoc. M. '47) Lt. Col., U.S. Army, Executive Officer, 36th Engr. Combat Group, 2nd Div. Headquarters, Quarters 261, Fort Lewis, Wash.

HERVIN, ALBERT WILLIAM, JR. (Jun. '47) Eng. Assignment, General Electric Co., Project Engr., Maintenance Dept. (Res., Dorm W-13, Apt. 102), Richland, Wash.

HITCHCOCK, JOHN (Assoc. M. '47) Designing Civ. Engr., Johannessen and Girand Engrs., First National Bank Bldg., (Res., 1113 West Neelia Drive), Phoenix, Ariz.

HOFFMAN, ORLANDO LEWIS (M. '47) Principal Engr. U.S. Engrs., 628 Pittock Block (Res., 406 North East 29th St.), Portland 12, Ore.

HOPE, DONALD BEAUMONT (Jun. '47) Engr. (special training), State Dept. of Highways (Res., 5802 Ionia St.), Richmond 19, Va.

HOPPE, SPENCER KEVIN (Jun. '47) Junior Civ. Engr., State Div. of Highways, 808 State Bldg. (Res., 11717 South Denver), Los Angeles, Calif.

HUBBARD, WARREN MELVILLE (Assoc. M. '47) Development Engr., Kaiser Co., Inc., Fontana (Res., 725 Chestnut Ave., Redlands), Calif.

HUNT, CARL JACKSON (Jun. '47) Asst. Instr., Civ. Eng., Univ. of Missouri, 151 Eng. Bldg., Columbia, Mo.

HUPP, HENRY THOMAS, JR. (Jun. '47) Asst. Mgr., Altavista Concrete Products, P.O. Box 389 (Res., P.O. Box 285), Altavista, Va.

IRBY, HOWARD EDGAR (Jun. '47) Structural Engr., Pate Eng. Co., 306 Richard Bldg., Tulsa, Okla.

ISAACS, ALVIN SIMON (Jun. '47) Civ. Engr., City of Santa Barbara, City Hall (Res., 1629 Garden St.), Santa Barbara, Calif.

ISMAIL, HASSAN MOHAMED (Jun. '47) Civ. Engr., Ministry of Public Work, Egyptian Govt., Calif. Inst. of Technology, Pasadena 4, Calif.

JENKINSON, ROBERT BERNARD, SR. (Assoc. M. '47) Res. Engr., Bluestone Reservoir Project, Corps of Engrs., Box 340, Hinton, W.Va.

KAB, BENJAMIN JOSEPH (Assoc. M. '47) Hydr. Engr., Corps of Engrs., St. Paul District, 1217 W. S. Post Office and Custom House (Res., 30 West Water St.), St. Paul 1, Minn.

KHURSALE, NARAYAN RAO (Assoc. M. '47) Divisional Engr., Care, Chf. Engr., Public Works Dept., Hyderabad, Deccan, India.

KINDERSLEY, CHARLES ST. BARBE (Jun. '47) Junior Engr., Sir Alexander Gibb & Partners, Queen Annes Lodge London, S.W.1. (Res., 18 Circus Bath, Somerset), England.

KING, JACK FREDERICK (Jun. '47) Field Engr., Hardway Cont. Co., East Eleventh St. (Res., 1219 Forest Ave.), Columbus, Ga.

KNAPP, HERBERT TOLFREE (M. '47) Lt. Col., Air Corps, U.S. Army, Staff Engr., Headquarters 13th Air Force, Army Post Office 719, Care, Postmaster, San Francisco, Calif. (Res., Care, A. J. Morris, P.O. Box 168, Ossining, N.Y.)

KRAFT, ALLISON FULLER (Jun. '47) Junior Engr., Virginia Eng. Co., Newport News (Res., 236 Mallory St., Phoebus), Va.

KUYKENDALL, ROY (Assoc. M. '47) Constr. Engr., Bonneville Power Administration, P.O. Box 3537, Portland 8, Ore. (Res., 12744 Dayton Ave., Seattle 33, Wash.)

LARSEN, ALF KLIFTON PAUL (Jun. '47) Engr., The Colorado Builder's Supply Co., 1534 Blake St. (Res., 4950 Tejon St.), Denver, Colo.

LAUSMANN, JOSEPH HERMAN, JR. (Jun. '47) (J. H. Lausmann Co.), 2289 North Interstate, Portland 1, Ore.

LAVALLA, DOMINIC C. (Jun. '47) Supt. of Constr., Grange Constr. Co., 349 East 149th St., New York (Res., 2030 East Second St., Brooklyn 23), N.Y.

LEARN, GLENN ALLEN (Assoc. M. '47) Project Engr., State Highway Comm., Forsyth, Mont.

LENTSCH, BENEDICT JOSEPH (Jun. '47) Engr., De Luca Constr. Co., 1055 Grant St. (Res., 2218 Sixth St., S.W.), Akron 14, Ohio.

LEOPOLD, GEORGE SELIGMAN (Jun. '47) 110-39 Sixty-ninth Road, Forest Hills, N.Y.

LIBBY, CHARLES JAMES (M. '47) Vice-Pres., The Robbins Ripley Co., 50 Church St., New York, N.Y. (Res., 378 Chapin Court, Oradell, N.J.)

LLOYD, LLOYD G. (Assoc. M. '47) Capt., CEC, U.S.N.R., (Retired); 3511 East First St., Long Beach 3, Calif.

LOHR, ALBERT FLOYD (M. '47) Designing Engr., The Jennings-Lawrence Co., Suite 538, Rowlands Bldg. (Res., 662 Sheridan Ave.), Columbus, Ohio.

LONG, ROBERT FRANCIS (Assoc. M. '47) (V. V. Long & Co., Cons. Engrs.), 1300 Colcord Bldg., Oklahoma City, Okla.

LOUIS, LEO, JR. (Assoc. M. '47) City Engr., City of Piqua, City Hall (Res., 911 Boone St.), Piqua, Ohio.

LUXION, WALTER WILLIAM (Jun. '47) Research Fellow and Graduate Student, Lehigh Univ., Fritz Eng. Laboratory (Res., 802 Linden St.), Bethlehem, Pa.

LYONS, JOHN EDWARD (Jun. '47) Asst. City Engr., City of Manchester, City Hall (Res., 16 Charleston Ave.), Manchester, N.H.

MACK, JOSEPH HARPER (Assoc. M. '47) County Surveyor and Road Commr., County of San Diego, 306 Civic Center (Res., 4344 Thirty-fifth St.), San Diego 4, Calif.

MARSHALL, JAMES PHILIP (Assoc. M. '47) Bldgs. Engr., Chesapeake & Potomac Tel. Co., 725 Thirteenth St., N.W. (Res., 2301 Forty-first St., N.W., Apt. 302), Washington 7, D.C.

MARTIN, DAVID C. (Assoc. M. '47) Structural Designer, General Electric Co., 1 River Road (Res., 1549 Union St.), Schenectady, N.Y.

MCALISTER, FRANCIS MARION (M. '47) Col., U.S. Marine Corps., Engr. Div., Depot of Supplies, 100 Harrison St. (Res., 1241 Grove St.), San Francisco 17, Calif.

MCEACHERN, COOPER (Jun. '47) Engr. Asst., South Carolina Highway Dept., T. & S., S.C.H.D. (Res., 3 Gibbes Court), Columbia, S.C.

MCKAY, PAUL JOSEPH (M. '47) Dist. Constr. Engr., State of Washington, Dept. of Highways, Box 90 (Res., 1210 "Y" St.), Vancouver, Wash.

MCMILLAN, RONALD JAMES (Assoc. M. '47) Engr. Mgr., Company Director, C. M. B. Constr. Co. Ltd., Longburn (Res., 30 Elmira Ave., Palmerston North), New Zealand.

MONTGOMERY, WILLIAM SLACK (Jun. '47) Asst. to Estimator, P.O. B. Montgomery, Builders-Engrs., Box 923, Dallas, Tex.

MOORE, GLENN WILLIAM (M. '47) Lt. Col., U.S. Army, Comdr., U.S.C. & G.S., 29th Engr. Topo Bn., A.P.O. 900, Care, Postmaster, San Francisco, Calif.

MORGAN, RUSSELL (Assoc. M. '47) Hydr. Engr., Ohio River Div., War Dept., Corps of Engrs., P.O. Box 1159 (Res., 3950 Werk Rd.), Cincinnati 11, Ohio.

MORRIS, JOHN JOSEPH (Jun. '47) Engr., Pipe Line, Texoma Natural Gas Co., Fritch, Tex.

MURPHY, ROBERT WILLIAM (Jun. '47) Draftsman, Stone & Webster Eng. Corp., 49 Federal St. (Res., 362 Marlborough St.), Boston, Mass.

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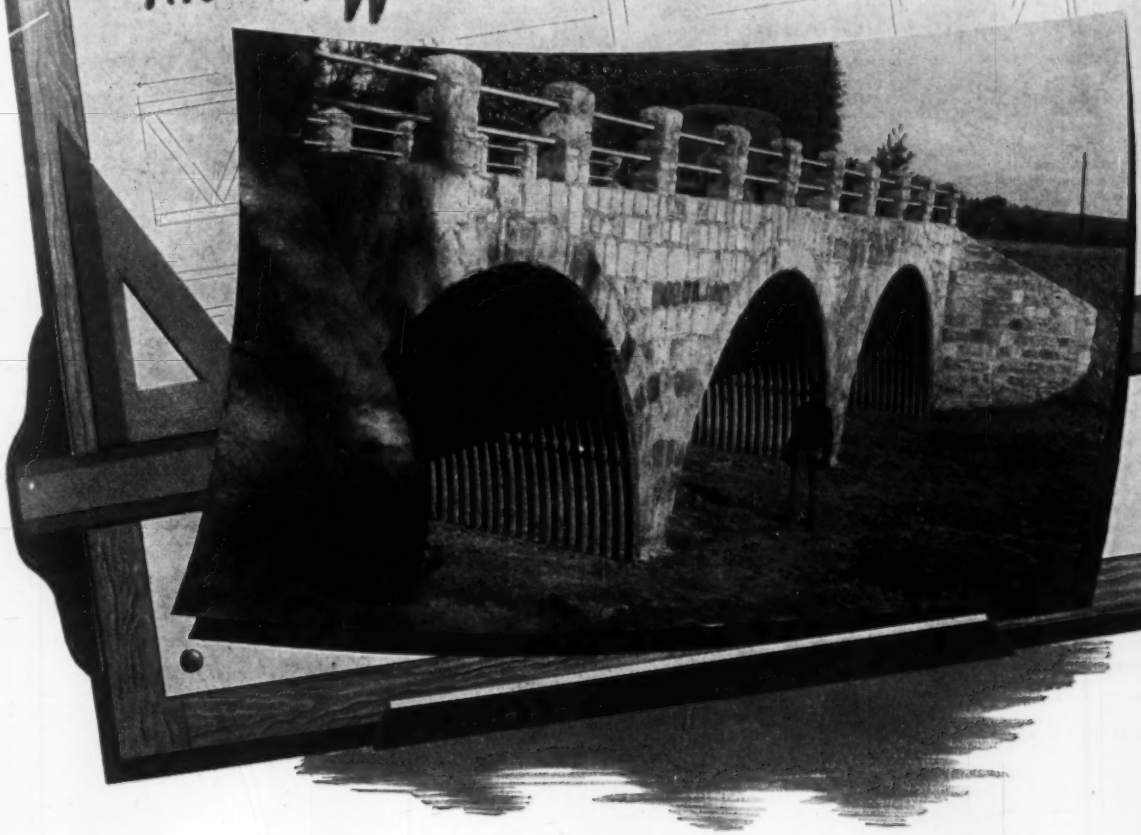

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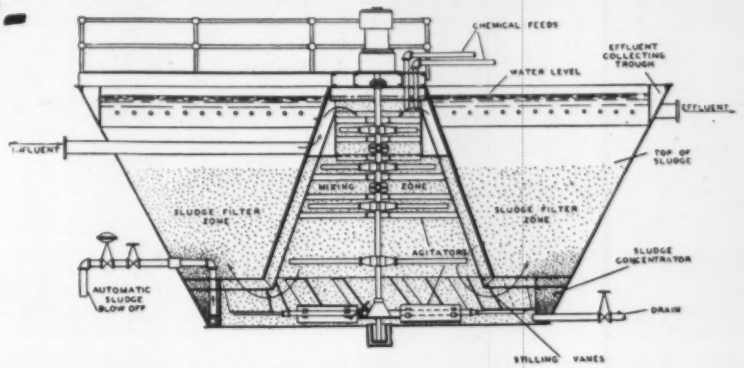


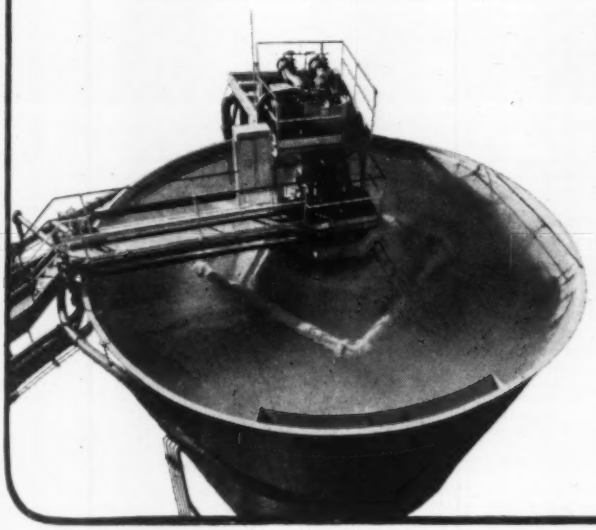

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DAVIDSON, NORMAN BENTLEY, M., Engr., Valco, Inc., 811 M & M Bldg., Houston 2, Tex., readmitted Aug. 11, 1947.

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ENGER, ARTHUR LUDWIG, M., Structural Engr., State Div. of Architecture, Public Works Bldg. (Res., 3701 Nineteenth St.), Sacramento, Calif., readmitted Aug. 11, 1947.

HALL, LOUIS WOODROW, Assoc. M., Supt., River Constr. Corp., P.O. Box 21, Granite City (Res., 141 Haller Ave., East Alton), Ill., readmitted Dec. 16, 1946.

ROESCH, THEOPHIL, Assoc. M., 433 Beach 38th St., Edgemere, N.Y., reinstated Aug. 11, 1947.

SMITH, SHERWOOD BADGER, M., Chf., Protective Constr. Branch, Office, Chf. of Engrs. (Res., 2230 California St., N.W.), Washington 8, D.C., readmitted June 16, 1947.

TEMPLETON, ALEXANDER SHANNON, Assoc. M., West Coast Mgr., Midland Constructors, Inc., Box 6999, Los Angeles 22, Calif., readmitted July 14, 1947.

TODD, LAZARUS HOUSTON, Assoc. M., Prin. Engr. (P-6), Chf. Strategic Logistics Section, Army Map Service, Corps of Engrs., U.S. Army, Washington, D.C. (Res., 3268 South Utah St., Arlington, Va.), readmitted May 19, 1947.

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BARNES, WILLIAM FRANCIS, JR., Jun., 1676 Syracuse Parkway, Denver, Colo., resigned Aug. 28, 1947.

CAMPBELL, CLYDE CECIL, Jun., 2017 East 82nd St., Chicago 17, Ill., resigned Aug. 27, 1947.

COLE, JACK MARION LEE, Assoc. M., 405 South Hill St., Los Angeles 13, Calif., resigned Aug. 28, 1947.

DEREMER, JAMES SILAS, Assoc. M., 330 East 19th Ave., Apt. 10, Denver, Colo., resigned Aug. 27, 1947.

DURANT, NICHOLAS JOHN, Assoc. M., 13 Bishops Park Road, Norbury, London, S.W., England, resigned Aug. 27, 1947.

FARHI, JOSEPH, Assoc. M., 49 Clarkson Ave., Brooklyn 26, N.Y., resigned Sept. 3, 1947.

GOWDY, JOSEPH SCOTT, Assoc. M., P.O. Box 3052, Houston 1, Tex., resigned Aug. 27, 1947.

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SHEPPARD, HERBERT RAMSEY, Jun., 2910-B Riverside Drive, Burbank, Calif., resigned Aug. 27, 1947.

## Recent Books

(*Continued from page 78*)

**$4.** Fundamentals, physical properties, and fluid statics are discussed in the beginning chapters, followed by a chapter on frictionless flow to lay the groundwork for a number of important principles arising therefrom. The principles of similarity and dimensional analysis are similarly considered, as important tools for future use. The discussion of frictional processes leads to flow in pipes and open channels, and fluid measurements are dealt with. Considerable revision, including some condensation and the deletion of certain advanced topics, has resulted in a shorter book despite the addition of recent developments. The principal change is the expansion of the original chapter on ideal fluid flow.

EXPERIMENTAL STUDY OF STRUCTURES. By A. J. S. Pippard. Edward Arnold & Co., London; Longmans, Green and Co., New York, 1947. 114 pp., illus., diagrs., charts, tables, 8¼×5½ in., cloth, $2.50; 9s. Based on a short course of lectures and demonstrations given at Oxford University, this volume attempts to interest students in the theory of structures. It consists of the presentation of the outstanding laws and theorems which are dealt with under the subject, and it gives examples of experiments which can be performed to supplement the lectures and the purely mathematical portions of a course. The use and effectiveness of small-scale models are well demonstrated.

THE GUARANTEE OF ANNUAL WAGES. By A. D. H. Kaplan. The Brookings Institution, Washington, D.C., 1947. 269 pp., 8×5 in., cloth, $3.50. This study was projected at the request of President Roosevelt for an official study of the annual wage under the auspices of the Advisory Board of the Office of War Mobilization and Reconversion in March 1945. The author believes that as the scope of the issue is extended to major sectors of the national economy, it must be studied in relation to the total economic setting which the guarantee of annual employment and wages may entail. Thus his study has been focused on the longer-run implications of a general adoption of annual-wage agreements, rather than on appraisal of individual company plans.

INTRODUCTION TO THE THEORY OF EQUATIONS, 2 ed. By L. W. Griffiths. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1947. 278 pp., diagrs., tables, 8½×5½ in., cloth, $3.50. The important general theorems in the elementary theory of algebraic equations are developed from the particular to the general. Complicated proofs are separated into simpler parts for easier understanding, and other such clarifying procedures are used wherever it seems needful. Determinants and complex numbers are also dealt with.

LESSONS IN ARC WELDING, 3d. The Lincoln Electric Co., Cleveland (Ohio), 1947. 158 pp., illus., tables, diagrs., charts, 8½×5½ in., cloth. Price, 50 cents postpaid in the United States; 75 cents elsewhere. This series of lessons forms the basis of instruction in the Lincoln Arc Welding School. Two basic types of courses are given—a first course in the fundamentals of arc welding, and advanced courses in alloy welding, sheet metal welding, and pipe welding.

MANUAL OF ENGINEERING DRAWING FOR STUDENTS AND DRAFTSMEN, 7 ed. By T. E. French; revised by C. J. Vierck. McGraw-Hill Book Co., New York and London, 1947. 694 pp., diagrs., charts, tables, 9½×6 in., cloth, $3.75. This revised and enlarged edition contains the usual information on instruments, drawing, dimensioning, sketching, perspective, maps, charts, graphs, and diagrams. A new chapter on illustration has been added, the chapter on perspective has been revised considerably, and the chapter on dimensioning expanded. Several new projective methods and explanations are included. When using this volume as a text, the author suggests the use of the McGraw-Hill Text-Films which were made specially to be companion material to the book.

MANUAL OF MATHEMATICS AND MECHANICS, 2 ed. By Guy R. Clements and Levi T. Wilson. McGraw-Hill Book Co., New York and London, 1947. 349 pp., diagrs., tables, charts, 9×6 in., cloth, $3.25. In this revised text, the tables of differentials and integrals have been combined and expanded. The sections on mechanics have been revised, and new material has been added on the applications of mathematics to certain engineering topics. A glossary and tables for use in courses in physics have been appended to meet special demands.

MEN AND VOLTS AT WAR. By John Anderson Miller. Whittlesey House, New York and London 1947. 272 pp., illus., 9×6 in., cloth, $3.75. This is the story of the General Electric Co. in World War II. It has been claimed that General Electric produced a greater variety of complex war equipment and was called upon to solve a greater variety of difficult technical problems than any other manufacturer. The organization's wartime accomplishments represented the work of more than 175,000 men and women, of whom many were singled out for special commendation by the Army, Navy, and other government agencies.

PRACTICAL GUIDE TO PREFABRICATED HOUSES. By A. L. Carr. Harper & Brothers Publishers, New York and London, 1947. 111 pp., illus., diagrs., 10¼×6½ in., cloth, $2.75. Giving examples of the work of 21 American prefabrication experts, the volume presents an overall picture of the field. A history of prefabrication is given and its advantages and problems are discussed. More than 100 photographs show the results that may be achieved by prefabrication. Facts about the companies and the type of house they build are noted. A directory of companies specializing in prefabricated houses, and a checklist of things to look for in buying a home are included.

PRINCIPLES OF INDUSTRIAL ORGANIZATION, 6 ed. By Dexter S. Kimball and Dexter S. Kimball, Jr. McGraw-Hill Book Co., New York and London, 1947. 531 pp., illus., diagrs., charts, 9×6 in., cloth, $4.50. A leading text in its field for more than 30 years, this book gives a comprehensive treatment of the internal organization and procedures of industrial enterprises, and a consideration of industrialism from the broader point of view of economic organization in general. The new edition is completely revised, with obsolete material deleted and much of the subject matter arranged for greater ease in use. There is considerable new material on ownership, industrial legislation, unionism, inspection, etc., and a new section on job evaluation and merit rating.

PROPERTIES OF ENGINEERING MATERIALS, 2 ed. By G. Murphy. International Textbook Co., Scranton (Pa.), 1947. 459 pp., illus., diagrs., charts, tables, 9½×6 in., cloth, $4.50. In dealing with the properties of engineering materials, special emphasis is placed upon the specific properties which are of major importance to the student of engineering. Material is presented to emphasize the basic principles underlying the behavior of engineering materials under conditions of usage. The behavior of materials under load, failure of materials, use of properties in design, qualities other than strength, and control of the properties of materials are discussed as well as the important specific materials themselves.

SURVEYING INSTRUMENTS AND METHODS. By Philip Kissam. McGraw-Hill Book Co., Inc., New York and London, 1947. 384 pp., illus., tables, diagrs., charts, 9×6 in., cloth, $3.50. The aim of the author has been to provide a brief but comprehensive course in surveying for students of all branches of engineering. The construction, theory, and use of the transit and level have been emphasized, and basic surveying methods are presented in detail. Contrary to usual practice, the transit is taken up before the level—an arrangement adopted after many years of experimentation in the author's own courses at Princeton University.

SYMPOSIUM ON ATMOSPHERIC WEATHERING OF CORROSION-RESISTANT STEELS, presented at the 49th Annual Meeting, American Society for Testing Materials, Buffalo, N.Y., June 24-28, 1946. American Society for Testing Materials, Philadelphia (1916 Race St.), Pa., 1947. 85 pp., illus., diagrs., charts, tables, 9×6 in., paper, $1.50. The seven papers included in this volume give an up-to-date picture of the behavior of the so-called stainless steels when exposed to the atmosphere in various shapes and under varying conditions. Numerous illustrations and tables increase the practical and ready application on the information presented.

WATER SUPPLY AND SEWERAGE, 2 ed. By Ernest W. Steel. McGraw-Hill Book Co., Inc., New York and London, 1947. 666 pp., illus., tables, diagrs., charts, 9×6 in., cloth, $6. Recent advances in water works and sewerage practice have made this second edition advisable. The present volume includes the 1942 U.S. Public Health Service Standards for drinking water, an improved and enlarged discussion of chlorine and break-point chlorination; and the addition of the threshold odor test of water. Recent innovations in water softening and water correction in general have also been described, as have improvements in sewage pumping and sewer maintenance.

WELDING ENCYCLOPEDIA, 12 ed. Completely Revised and Reedited by T. B. Jefferson.

(*Continued on page 92*)

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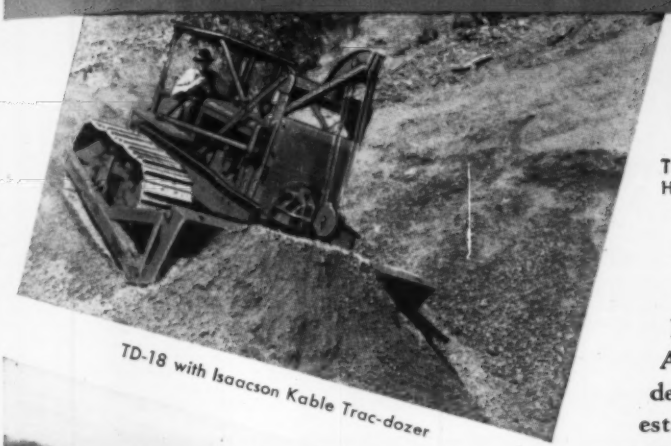

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# INTERNATIONAL POWER

**CRAWLER AND WHEEL TRACTORS • DIESEL ENGINES • POWER UNITS**

(Continued from page 90)

originally Compiled and Edited by L. B. Mackenzie. Welding Engineer Publishing Co., New York 18, 1947. 1024 pp., illus., diagrs., tables, 9×5½ in., fabrikoid, $6.50. From abrasion to zirconium this standard reference work covers all terms relating to the broad field of metal joining and cutting by the application of heat, including heat treating processes and other allied subjects. Photographs, line drawings, graphs, data tables, and equilibrium diagrams are extensively used to illustrate or amplify the text. Various pertinent codes, standards, and specifications are appended, and there is a 90-page list of trade names with descriptive information. The volume has been revised throughout in accordance with current practice.

**Books in the Engineering Societies Library may be borrowed by mail by ASCE members for a small handling charge. The Library also prepares bibliographies, maintains search and photostat services, and can provide microfilm copies of any item in its collection. Address inquiries to Ralph H. Phelps, Director, Engineering Societies Library, 29 West 39th Street, New York 18, N.Y.**

YOUR CITY TOMORROW. By G. Gruen. The Macmillan Company, New York, 1947. 210 pp., maps, 8¼×5¼ in., cloth, $2.50. A general history of the growth of cities and the methods used to combat decentralization, blight and slums and threatened fiscal breakdown comprises this book. There is a description of efforts made in the past fifty years to cope with the urban problem. Housing, the money problem, and plans for the future rehabilitation of urban areas are discussed and special mention is made of Boston's comprehensive plans for reorganization.


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CHIEF OF PARTY, 25–35 preferred, civil engineer, qualified for field party survey, light construction, open-pit mining, and competent in notes and office work. Salary, about $3,200 a year. Location, Central Florida. W-9437.

PROJECT MANAGER, civil graduate, 40–50, with at least 10 years' pier, bulkhead and waterfront construction experience, to supervise harbor improvements. Must have had Latin-American experience. Salary, $8,000–$10,000 a year. Location, Venezuela. W-9468.

DESIGNER, civil graduate, with at least 5 years' heavy construction design experience, to design and lay out foundations and structures for rolling mill equipment. Salary $5,000–$6,000 a year. Location Pennsylvania, with probable 10 to 12-month trip to Africa. W-9478.

ENGINEERS. (*a*) Soil Mechanics Technician for research work. Salary, $3,300–$3,800 a year. (*b*) Assistant Professor to teach reinforced concrete and lead concrete research. Salary, $3,800–$4,500 a year. Location, Florida. W-9523.

OFFICE ENGINEER AND ESTIMATOR, 30–35, civil graduate, with at least 5 years industrial construction experience, for general contracting firm. Salary, $5,000–$6,000 a year. Location, Ohio. W-9525-D.

ARCHITECTURAL DRAFTSMAN, thoroughly experienced, who knows building details. Must be neat and rapid draftsman, for consulting engineer. Write giving experience, salary desired and submit sample of drafting. Location, Louisiana. W-9529.

ENGINEERS. (*a*) Rodmen, recent civil graduates, with or without experience for survey party. Salary, $3,120 a year, based on a 40-hour week, plus overtime. One-year contract. Single status. (*b*) Electrical-Mechanical Field Engineer for inspection of electrical-mechanical installations. Should have some construction experience. Salary open. Sleeping quarters and three meals a day, $1.50 a day. Location, Iceland. W-9536.

ENGINEERS. (*a*) Structural Designer for highway and bridge work. Salary, $4,200–$5,400 a year. (*b*) Sanitary Designers for sewer systems and sewage disposal plants. Salary, $4,200–$5,400 a year. (*c*) Highway Engineer. Salary, $3,600–$4,800 a year. (*d*) Engineers experienced in water works appraisal work. Salary, $4,200–$4,800 a year. Location, Pennsylvania. W-9553.

INSTRUCTORS, civil graduates, to teach elementary and route surveying or other civil engineering subjects. Location, Alabama. W-9558.

SANITARY ENGINEER, 30–35, single preferred, sanitary engineering training, preferably with tropical sanitary engineering experience. Salary, $4,800–$6,000 a year plus room and board. Duration 2 years, possibly longer. Location, Dutch East Indies. W-9572.

DESIGN ENGINEERS, 35–45, experienced in the field of water treatment, hydraulic systems, sewage treatment and sewerage systems, both storm and sanitary. Salary good, and opportunity for advancement. Location, Ohio. W-9602.

EDUCATION COORDINATOR, civil graduate with at least 5 years' experience in education and building products field to supervise commercial courses covering lumber, brick, hardware and general building supplies. Salary, $3,500 a year. Location, New York, N.Y. W-9606.

PLANT SURVEY ENGINEER, graduate, with at least 5 years airport plant and equipment experience, to supervise construction and maintenance facilities including personnel housing. Two-year contract. Salary $6,000 a year plus allowances. Location, Far East. W-9613.

ENGINEERS. Must report single status for one year. Should have knowledge of Spanish. (*a*) Construction Engineer, to 45, civil graduate, with at least 2 years' experience on housing and industrial buildings. Salary, $5,400 a year. (*b*) Surveyor and Layout Engineer, to 30, civil graduate, with some experience in the field and office as a surveyor and draftsman, to make surveys and building layouts, keep maps up to date, and to project and design water-distribution mains, sewers, roads and grading. Salary, $4,200–$4,800 a year. Recent graduate without experience, $3,600 a year. (*c*) District Engineer, 35–45, civil graduate, with at least 10 years' experience in field and office work covering construction of housing, industrial buildings, roads, water supply, sewers and other construction applying to oil fields. Should be able to direct both field and office work and conceive and design work. Salary, $6,000 a year. Location, Venezuela. W-9616.

CONSTRUCTION ENGINEER, civil graduate, 35–42, with at least 10 years' industrial plant construction and maintenance experience, to plan, design, and supervise alterations and additions under direction of plant engineer. Salary $6,000–$7,500 a year. Location, Brooklyn, N.Y. W-9625(*b*).

CIVIL ENGINEERS. (*a*) Construction Engineers with experience in construction of petroleum refineries and qualified to take responsible charge of large refinery construction projects. State education, qualifications, experience, salary requirements and data available. (*b*) Construction Engineers with experience in construction of petroleum refineries. State education, qualifications, experience, salary requirements and date available. Location, Pennsylvania. W-9635.

ENGINEERS, under 35. (*a*) Structural Engineer for water, sewerage and power plant design. (*b*) Civil Engineer for street, airport and similar types of design. Recent graduates will be considered. Permanent. Write giving details of education and experience. Location, Iowa. W-9636.

RESEARCH ENGINEER, to head research laboratory, experienced in laboratory testing technique of both concrete and steel, and familiar with reinforced concrete design with ability to carry out research programs. Location, Middle Atlantic States. W-9661.

**This placement service is available to members of the Four Founder Societies. If placed as a result of these listings, the applicant agrees to pay a fee at rates listed by the service. These rates—established to maintain an efficient nonprofit personnel service—are available upon request. The same rule for payment of fees applies to registrants who advertise in these columns. All replies should be addressed to the key numbers indicated and mailed to the New York Office. Please enclose six cents in postage to cover cost of mailing and return of application.**

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# CATALOG DIGESTS of ENGINEERING and INDUSTRIAL Interest

### 1 ACRA-COATING PROCESS

**Acra Instruments**—Latest booklet describes the Acra-Coting process as applied to optical lenses of photographic and surveying instruments. It explains the advantages gained by reducing surface reflection from optical systems. This reduced reflection and increased light transmission are described in the booklet and demonstrated by an accompanying sample.

### 2 ADVANTAGES OF CONTRACT DEWATERING

**American Dewatering Corporation**—Two booklets briefly outlining the advantages of contract dewatering and illustrating and describing projects of various types predrained in the past few years.

### 3 AIR INLET VALVES

**Simplex Valve & Meter Company**—Announces a bulletin on installation and operation of air inlet valves. Elimination of thin-walled gravity flow line collapse resulting from sudden drops in pipe-line pressure is discussed. The bulletin includes nomographs and tables for accurate determination of correct positioning, frequency, and size of air inlet valves required for trouble-free operation of the gravity flow line. Details of the principle of installation and operation, and the design and construction of the Simplex Air Inlet Valve are covered.

### 4 AIR MOTORS

**Gardner-Denver Company**—offers a catalog describing the various sizes and designs of five cylinder radial air motors, their wide range of application for powering equipment where flexibility, safety, and convenience of compressed air is desired.

### 5 AIR RELEASE VALVES

**Simplex Valve & Meter Company**—The operation, construction, and essential requirements of air release valves are described in a new bulletin. The booklet discusses dangers of air in pipe lines and the only safe solution to the problem—well designed, large capacity air release valves, which operate continuously and without attention.

### 6 ANGLING BLADE BULLDOZER

**Caterpillar Tractor Company**—The booklet outlines the structural advantages of the new cable-controlled angling blade bulldozers which are designed for use with the "Caterpillar" Diesel D8 and D7 track-type tractors. It also emphasizes and illustrates, with model and cutaway views, blade C-frame, brace, sheave, and push cap construction and angling, tilting and lifting adjustments possible. Several job scenes of angling blade bulldozers in action are shown in the booklet.

### 7 AQUELLA AND CONCRETE MASONRY CONSTRUCTION

**Prima Products, Inc.**—offers a profusely illustrated bulletin explaining the principle upon which Aquella works to act as an effective water barrier on concrete masonry structures. The balanced composition of the product, its ability to penetrate microscopic pores, its power of expansion during curing, and the firmness and durability of the coating it produces are some of the advantages of Aquella described in the bulletin.

### 8 THE BARRETT ROAD BOOK

**The Barrett Division**—The Barrett Road Book is a compilation of tables and information concerning road construction and maintenance. Tables of highway quantities are included and the various methods of using Tarvia Road Tar and Tarvia-lithic Tar Concrete are described.

### 9 BETTER AND MORE ECONOMICAL CONCRETE

**The Master Builders Company**—New 32-page book tells the story of Pozzolith and its benefits; illustrates and describes cement dispersion; tells how Pozzolith cuts initial and upkeep costs; discusses controlled air entraining action of Pozzolith; describes dispenser for easy, accurate use; tells how to specify Pozzolith, and shows many pictures of structures illustrating benefits resulting from the use of Pozzolith.

### 10 BITUMINOUS CONSTRUCTION

**Barber-Greene Company**—36-page Catalog describing principles of operation of Barber-Greene Tamping-Leveling Finisher for bituminous paving. Six-page Bulletin MP explaining Barber-Greene Maintenance Plant for bituminous mixing, including material flow chart. Descriptive folder on Barber-Greene High-Capacity Bituminous Mixing Plant, including specifications and dimension drawings of Barber-Greene Model 837 Dryer, Model 866 Gradation Control Unit, Model 880 Hot Elevator, and Model 848 Mixer.

### 11 BORINGS

**Raymond Concrete Pile Company**—A booklet "Borings—Why and How," tells a comprehensive story of Raymond's method of making soil investigations essential to the proper design of every structure.

### 12 BRIDGE DECKING

**Irving Subway Grating Co., Inc.**—Catalog F300 contains illustrations, descriptions and engineering data on Irving Decking, the original open steel mesh floor—outlines features including roadway safety in any maximum traction.

### 13 BUCKETS

**Blaw-Knox**—offers a catalog giving illustrations diagrams, and tables of Two-Line Lever Arm Buckets for rehandling, barge clean-up, general purpose, hard digging, dredging, and other industrial uses.

### 14 CAST IRON PIPE

**R. D. Wood Co.**—A 4-page illustrated leaflet, "Sand-Spun Pipe," sets forth the merits of this pipe which is cast centrifugally in warm sand-lined molds. This gives, as stated in the leaflet, freedom from stresses; greater elasticity; toughness; and increased tensile strength which permits longer lengths, and thus fewer joints in the line.

### 15 CAST IRON PIPE DATA

**United States Pipe and Foundry Company**—U. S. Super-deLavaud Cast Iron Pipe Catalog contains specifications, weights and detailed dimensions of Super-deLavaud centrifugally spun Cast Iron Pipe—sizes available are 3 through 24 inches, lengths 12 and 18 feet—for water, gas, sewer and industrial service.

### 16 CEMENT GUN

**Cement Gun Company**—Bulletin 2300 describes the "Cement Gun" and the uses of its product "Gunite." This 72-page booklet contains design and test data and descriptions of work done in various types of construction from dwelling and factory buildings to that of dams, reservoirs, prestressed tanks, sewers, tunnels, stacks, coal bunkers, steel encasement, mine and refractory work. The use of "Gunite" for repairs to disintegrated concrete and masonry and for protection of steel against normally destructive conditions is fully described.

### 17 CHAIN BELTS

**Chain Belt Company**—A newly published bulletin on REX Steel Fabricated and Cast Chains for Every Industry. All the Company's standard chains are illustrated and briefly described. In addition, three pages of installation photographs show typical examples of how each style REX Chain is applied in industry; two pages illustrate standard attachments and their use; and one page contains information on REX Cast and Cut Tooth Sprockets.

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| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27* | 28* | 29* | 30 |
| 31 | 32 | 33 | 34 | 35* | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
| 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56* | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 |
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**NOT GOOD AFTER NOVEMBER 20, 1947, for readers in the U.S., but requests will be accepted to December 31, 1947, from readers outside of this country.**

There are 112 Digest items on pages numbered 94 to 112. Read all items for the literature of interest to you.

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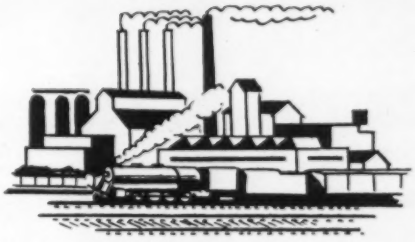

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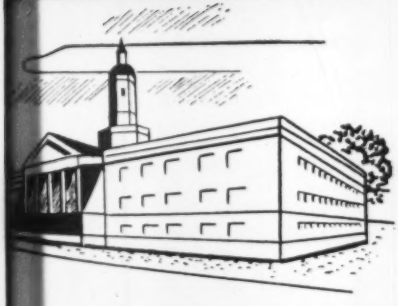

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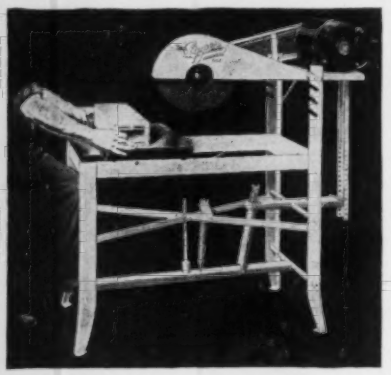

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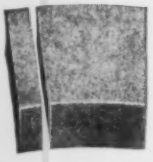

Rotary Kiln Blocks, cut to size for "key" bricks in rotary kilns, require only 10 sec. for completion of cut.

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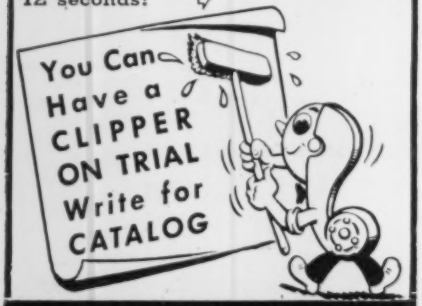


**CLIPPER MFG. COMPANY**
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## CATALOG DIGESTS

### 18 CHEM-O-FEEDERS

**% Proportioneers, Inc. %**—Bulletin describes application of Chem-O-Feeders for chlorination and chemical feeding to municipal and private water supplies, sewerage treatment and swimming pools. Exclusive "See-Thru" reagent heads permitting visible inspection of all moving parts in contact with chemical solution, accuracy, positive displacement, smallness of size, corrosion resistance, and ability to operate under high pressure are advantageous qualities discussed in bulletin.

### 19 CHRISTMAS CATALOG

**Georg Jensen, Inc.**—announces a new Christmas catalog filled with novel, beautiful and exclusive gifts certain to please everyone, and particularly those who desire gifts that are "just a little bit different," such as the Arithmo, a fine 17-jewel wrist watch combining a slide rule which has all the accuracy of the best pocket rule.

### 20 COATINGS

**Wailes Dove-Hermiston Divison**—New 28-page handbook on Bitumastic Hot and Cold Applied Coatings for: oil and gas lines, water and sewage pipe lines, water and storage tanks, hydro-electric projects, ships, and concrete and metal surfaces. It contains a 2-page Coating Guide for various other services.

### 21 COLD WEATHER CONCRETING

**Lone Star Cement Corporation**—16-page illustrated booklet giving detailed suggestions for minimizing winter concreting cost through the use of Incor-24 Hour Cement. Contains actual job records where heat-protection costs were reduced by 50%, with similar savings in forms and overhead. Tables give mix proportions and approximate effect of temperatures on compressive strength of concrete.

### 22 COMPRESSORS, PORTABLE AND STATIONARY

**The Jaeger Machine Company**—Specification No. JC-5 provides complete data on super-efficient "Air-Plus" 2-stage, air-cooled compressors. Portable, fast-trailing, models from 60 to 500-cu ft capacities; gasoline or diesel powered. Described in detail are advanced design and aircraft engine standards of manufacture plus giant illustrations of principal models. Line includes electric-drive stationary models, skid-mounted, truck-mounted and trailer models and the Travel-Air tractor mounted and powered outfit.

### 23 CONCRETE FLOORS

**Lone Star Cement Corporation**—16-page illustrated booklet describing methods and procedures for placing heavy-duty floors for new jobs as well as resurfacing or patching old floors. Contains detailed specifications, and outlines common construction faults and how to avoid them. Also gives method for resurfacing worn industrial floors over a week-end with Incor 24-Hour Cement, avoiding plant tie-up.

### 24 CONCRETE MIXERS

**Chain Belt Company**—The new REX 11S and 16S concrete mixers are described in a bulletin. These new machines feature portability, high production, low over-all cost, dependability, easy operation and stream-lined appearance. Mechanical details such as 3-way mixing action, chain drum drive, shimmy skip, accurate water system, one man hitch, etc., are plainly illustrated and described. Complete specifications on all parts of the mixers are also included.

### 25 CONCRETE PILES AND CAISSONS

**Western Concrete Pile Corporation**—An 8-page bulletin describes the various types of concrete piles and caissons. Illustrations of each type of pile are shown with a description of the advantages, carrying capacity and other characteristics. Also included is a list of outstanding jobs executed by Western Concrete Pile Corporation.

### 26 CONCRETE PIPE

**Lock Joint Pipe Company**—Technical and descriptive data in illustrated pamphlet form describing the design, manufacture and installation of concrete cylinder pipe, prestressed concrete cylinder pipe and subaqueous pipe. Illustrated pamphlets and charts explaining flow and leakage tests, joint designs and other technical matters. Also a booklet tabulating the dimensions and weights of sewer and culvert pipe.


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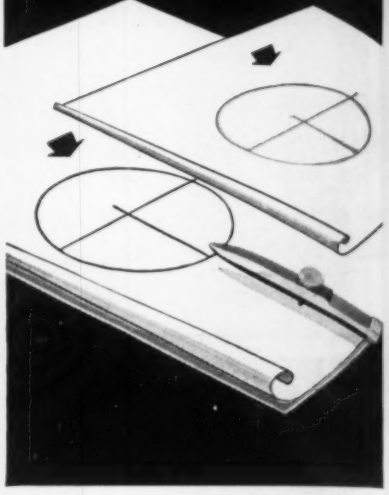

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# WORLD'S LARGEST MOST POWERFUL TRACTOR

## Allis-Chalmers HD-19

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COMPLETELY NEW...with HYDRAULIC TORQUE CONVERTER DRIVE

### BUILT TO GET MORE WORK DONE

- Weight: 40,000 pounds.
- Power: 2-Cycle General Motors Diesel — 163 hp. at flywheel.
- Torque converter automatically balances load and speed without gear-shifting.
- Speeds: 0 to 3.0 in low gear and 0 to 7.0 in high; reverse, 0 to 5.5.
- More traction, more ground contact, better balance.

### BUILT TO LAST LONGER WITH LESS UPKEEP

- Torque converter smooths tractor performance—cushions engine and transmission from shock loads.
- Simplified maintenance — major assemblies conveniently serviced or removed. Operating adjustments easily reached, quickly made.
- Reduced lubrication — greasing intervals lengthened throughout . . . 1,000 hours on truck wheels, support rollers, front idlers.
- High clearance—over 16 inches.

### BUILT FOR EASIER CONTROL — GREATER OPERATOR COMFORT

- Torque converter eliminates most shifting.
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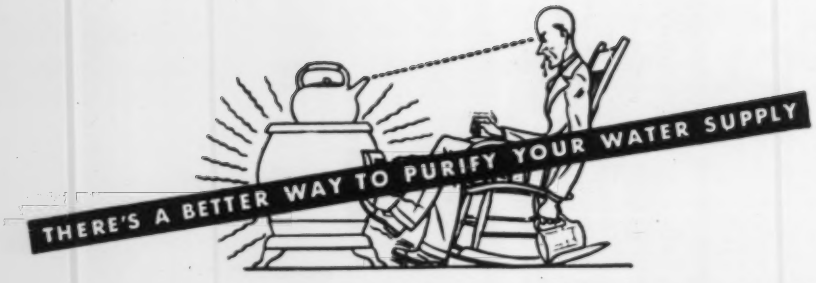
- Convenient controls.
- Self-energizing brakes.
- New type, adjustable split seat.
- Wide arm rests.
- Adjustable brake pedals.
- Full visibility.
- Comfortable foot rests.
- Clean platform.

## ALLIS-CHALMERS ...Originator of the Torque Converter Tractor

TRACTOR DIVISION — MILWAUKEE 1, U. S. A.




# %PROPORTIONEERS%

## HEAVY DUTY CHEM-O-FEEDER

Even if the watched kettle never boils you can have safe, pure water with %Proportioneers% Heavy Duty Chem-O-Feeder. This inexpensive, dependable chemical feeder will automatically purify up to a million gallons of water a day. Cross-connected to the starting switch of the main pump motor, the Chem-O-Feeder operates exactly in step with the pump and sterilizes every drop of water. It feeds just the right amount of hypochlorite or other chemical — eliminates the unpleasant taste resulting from overfeeding, and prevents dangerous undertreatment. Write for Bulletin SAN-2.

ADJUSTMENT WHILE IN MOTION. By simply turning a knob which varies the stroking length, the amount of chemical fed can be precisely adjusted while the pump is operating.
CONTINUOUS FEEDING. Unique stroking arrangement gives long feeding stroke and short suction stroke — provides uniform distribution.
"SEE-THRU" PLASTIC REAGENT HEAD. Safely handles all water treating chemicals — shows the movement of the parts and the flow of liquid being fed.
PROVEN DESIGN. Over 24,000 "Proportioneers" units are in use all over the world.

# % PROPORTIONEERS, INC. %

14 Codding Street, Providence 1, R. I.

**27** CONCRETE PIPE FOR IRRIGATION AND DRAINAGE

**American Concrete Pipe Association**—A 100-page, profusely illustrated manual on various phases of irrigation such as design and construction of irrigation pipe lines and appurtenances with descriptions of many irrigation projects. Also standard specifications and other pertinent data. This book is priced at $0.50 postpaid.

*N.B. There is a charge for this book. Make checks payable to the American Concrete Pipe Association.*

**28** CONCRETE PIPE LINES

**American Concrete Pipe Association**—A 300-page, profusely illustrated manual describing methods of constructing concrete pipe lines, concrete pipe in American sewerage practice, its use for drainage structures for highways, railroads and airports. Also standard specifications and other pertinent data. This book is priced at $1.75 postpaid.

*N.B. There is a charge for this book. Make checks payable to the American Concrete Pipe Association.*

**29** CONCRETE PIPE LOADS

**American Concrete Pipe Association**—presents a manual giving information and data compiled from the results of a series of full-scale tests under normal field conditions. Described are: testing procedures and apparatus, types of concrete pipe used, soil conditions, and methods of bedding and laying. Included, also, is a trench test chart, compiled by the Technical Problems Committee of the Association. This book is priced at $0.10 postpaid.

*N.B. There is a charge for this book. Make checks payable to the American Concrete Pipe Association.*

Return the coupon to-day!

# CATALOG DIGESTS

**30** CONDENSED LIFT TRUCK

**Hyster Company**—Catalog pictures, describes and lists specifications on the complete line of Lift Trucks, Straddle Trucks, and Mobile Cranes which are all specially designed for operation on pneumatic tires which allow faster operation over rougher and steeper surfaces and make easier riding both for the load and for the operator.

**31** CONSTRUCTION OF TUNNELS

**Armco Drainage & Metal Products, Inc.**—The efficient and economical construction of an underpass, conduit, or tunnel to provide underground passageways for people, livestock merchandise, or utility lines is the subject of a new 24-page manual providing pictures and data on sizes and shapes of openings, conveyor tunnels, and available metal structures. Suggestions are given on floors, drainage, lighting, brackets and end treatment.

**32** CONSTRUCTION EQUIPMENT

**Blaw-Knox**—presents an illustrated catalog giving basic data on steel street and road forms, concrete paving spreaders and finishing machines, bins and batchers, turntables, tamping rollers, concrete and clamshell buckets, heavy steel forms, and standard portable steel buildings.

**33** CORR-PLATE STEEL PILING

**Caine Steel Company**—Catalog gives complete specifications and shows application photo and descriptions of Corr-plate steel piling now being rolled from a new high-strength steel alloy. In a series of bending, compression and tensile strength tests, piling made of the new alloy proved to be 25% stronger than the same piling made of mild steel. Other tests showed the new alloy to have double the corrosion resistance, and thus an indicated life of twice that of mild steel piling.

**34** DEFORMETER GAGES

**George E. Beggs, Jr.**—A practical method of solving indeterminate structures by elastic models is offered in the application of the Beggs Deformeter Gage, developed by Professor George E. Beggs. The model automatically takes into account the effect of thrust and shear deformations, brackets, stress distribution around corners, etc. Descriptive literature on available Deformeter Gages and accessories, theory, and application.

**35** DESIGN FOR ARC WELDED STEEL STRUCTURES

**Air Reduction Sales Company**—A 300-page definitive work, the first of its kind to be published, was compiled by LaMotte Grover, M. ASCE, a recognized authority in the field of structural welding. The book covers: fundamentals of design materials, inspection, estimating, engineering control of welding and related operations, electrode requirements, specifications for welded connections for all sizes of rolled beams, and a series of diagrams for rapid design of welded connections. The price of this book is $2.00 postpaid.

*N.B. There is a charge for this book. Make checks payable to the Air Reduction Sales Company.*

**36** DIAMOND CORE DRILL

**Pennsylvania Drilling Company, Inc.**—offers a folder illustrating a new light mobile Diamond Core Drill mounted on a jeep that moves fast, and goes anywhere due to the short wheel base and narrow gage which facilitates passage through woods and over rough ground. How it provides fast drilling and can be removed in a few minutes, thus releasing the jeep for general use when drill is idle, is also described.

**37** DIAMOND CORE DRILLING

**Pennsylvania Drilling Company, Inc.**—introduces a folder illustrating the methods used in Diamond Core Drilling for obtaining and preserving core taken from bore holes in prospecting for coal and minerals, and in connection with test borings for bridges, dams and buildings.

**38** DIESELS BUILD THE HIGHWAYS OF TOMORROW

**Caterpillar Tractor Company**—Liberally illustrated with active job scenes, the 16-page color publication shows Diesel track-type tractors, equipped with straight or angling type bulldozers, performing pioneering, short haul and heavy road work; equipped with scrapers for medium haulsand leveling; Diesel powered wheel type tractors for high speed, long hauls; and Diesel motor graders for haul road maintenance, backsloping and fine finishing. It points also to Diesel engine installations in draglines, shovels, compressors, and crushing plants.

"Impossible" is a word that is not recognized by engineers. To dam a mighty river, tunnel under it or suspend a bridge across it—things such as these that once seemed pure imagination were made possible by instruments devised to refine and extend human faculties, to translate the precision of engineering thought into action.

Keuffel & Esser Co. is proud to have played so large a part in making such instruments widely available. In this way K & E equipment and materials have been partners of the engineer and draftsman for 80 years in shaping the modern world. So universally is this equipment used, it is self-evident that K & E have played a part in the completion of nearly every engineering project of any magnitude. Could you wish any surer guidance than this in the selection of your own "partners in creating"?

Not only for construction and building, but for setting up precision machine tools and long production lines, in the fabrication of large ships and aircraft, experienced engineers know that they can rely utterly on K & E transits and levels. Coated lenses for increased light transmission, precision-ground adjusting screws, chromium-coated inner center and draw tubes, completely enclosed leveling screws, improved achromatic telescopes—all these typify the advanced design of these instruments.

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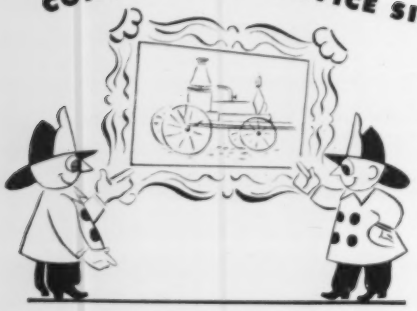
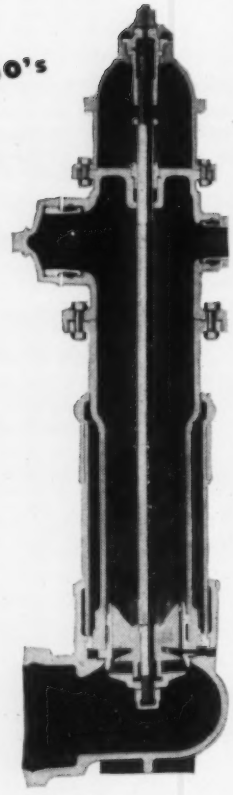
**CONTINUOUS SERVICE SINCE THE 1800's**





Thousands of Mathews Hydrants have been in continuous service for three quarters of a century. It's the way they're built.

Take the valve assembly, for example. The drain valve, positive and automatic, is an integral part of the guide and the upper main-valve plate. Keyed to the hydrant stem, it moves vertically with the main valve. As the main valve opens, the drain valve closes the orifice, and vice versa. The main valve, true compression type, opens *against*, and closes *with*, the pressure; there is no strain, no leakage—even if the hydrant should be broken in traffic. The assembly being cone-shaped, the water can be turned on or off gradually—no water hammer, minimum friction, minimum deposit of sediment on the valve seat.

Mathews have long been the leading hydrant the world over. Insist that your community have the extra protection of this famous make.

**OTHER FEATURES OF MATHEWS LEADERSHIP**

Head can be rotated a full circle, on swivel flange • Replaceable head permits change in nozzle outlets • Nozzle levels can be raised or lowered without excavating • Barrel screws into bronze bushing in elbow • Operating thread (easily accessible) is only part that needs oiling • Stuffing box plate cast integral with the nozzle • Shield operating nut keeps out dust, rain, sleet • Maintenance and repair expense kept to the minimum.

**MATHEWS HYDRANTS**

*Made by* **R. D. WOOD COMPANY**

PUBLIC LEDGER BUILDING, INDEPENDENCE SQUARE, PHILADELPHIA 5, PA.

**Manufacturers of "Sand-Spun" Pipe (Centrifugally Cast in Sand Molds) and R. D. Wood Gate Valves**


# CATALOG DIGESTS

### 39 DIESEL CRAWLER TRACTORS

**International Harvester Company**—This 48-page two-color catalog illustrates and describes in comprehensive detail four models of International crawler tractors. Action photographs and description serve to list some of the applications of this equipment. The catalog describes engine and chassis design and construction on each model with a wealth of detail. Illustrations of mechanical features include phantom views, cross sections, and straight photographs. Operating information and complete specifications are also included.

### 40 DIESEL OIL

**Standard Oil Company**—New 12-page booklet, "Nonpareil Diesel Oil . . . Available in Regular and Heavy Duty Types." This booklet gives a brief description of the product and its advantages for Diesel power units in all engineering applications. It contains oil maintenance tips. One of the outstanding features of this booklet is the very helpful listing of jacket water temperatures as recommended by leading Diesel engine manufacturers. A maintenance booklet of value.

### 41 DOORS, STEEL ROLLING

**Kinnear Manufacturing Company**—The advantages, the economy, the construction features, and the general specifications of the various types of Kinnear wood and steel upward-acting type doors are fully discussed and illustrated in a new catalog and data book just published. Known as Bulletin 48, it gives information on insulation clearance requirements, methods of operations and controls, as well as the adaptability of the doors for many types of uses. This 40-page illustrated catalog is a valuable reference for anyone interested in building or building maintenance.

Make full use of this CATALOG DIGEST SERVICE. Mail the coupon on page 94 to-day.

### 42 DUSTLESS MASONRY SAW

**Clipper Manufacturing Company**—announces new "Dustless" masonry saw with dual control. Features described are: multiple, forced, and oscillation cutting, foot pedal control, pressure equalizer, ball bearing conveyor cart, snap-on blade cover, seven pivot positions, stabilizer control, full vision of cut, streamlined blade guard, self-priming pump, and totally enclosed motor.

### 43 EARTHMOVING

**Caterpillar Tractor Company**—shows what its equipment and auxiliary units can do in big and small earthmoving operations in a new 16-page booklet. Diesel track-type and wheel-type tractors with appropriate trailed units, bulldozers, and scrapers, Diesel motor graders, Diesel engines and electric sets are pictured in active job scenes as prime movers or as power sources for other equipment for the many and varied types of earthmoving activities.

### 44 ELECTRIC FISH SCREEN

**Electric Fish Screen Company**—A new illustrated single sheet describes the Burkey method of positive fish control, employing specifically engineered electrode systems energized by electronic generators. Designed to prevent fish from entering hydro-electric plants, water systems, and pumping stations as well as to fence fish within lakes and private preserves. The control unit is harmless to marine life.

### 45 EQUIPMENT FOR CONSTRUCTION

**Hyster Company**—Catalog describes products adaptable to construction when mounted on "Caterpillar" track-type tractors. How the Hystaway machine, which combines a dragline, clamshell, and crane with the "Caterpillar" tractor, can be used with the D8 model as well as the D7 and D6 model tractors is thoroughly explained.

### 46 ENGINEERING PROPERTIES AND APPLICATIONS

**International Nickel Company, Inc.**—Ni-Resist—revised—36 pages, well illustrated. This booklet gives detailed information on the physical and mechanical properties of this widely used cast nickel alloy. Performance under a wide variety of industrial conditions involving corrosion, heat and wear is described. Corrosion data for 400 corrosive media are presented in tabular form. Completely indexed.

### 47 ENGINEERING, SURVEYING AND BUILDING INSTRUMENTS

**David White Company**—An extremely detailed, beautifully illustrated book containing 217 pages of information on all types of surveying, building and engineering instruments and accessories. Included in the catalog are the hundreds of office and field equipment items also available—such as drafting papers, slide rules, tables, drawing instruments, scientific books and many others.

### 48 EQUIPMENT FOR FIRE PROTECTION

**M & H Valve & Fittings Company**—This catalog covers Underwriters and Factory Mutuals approved fire hydrants, gate valves, indicator posts, check valves and underground fittings used in connection with automatic sprinkler and private fire protection systems.

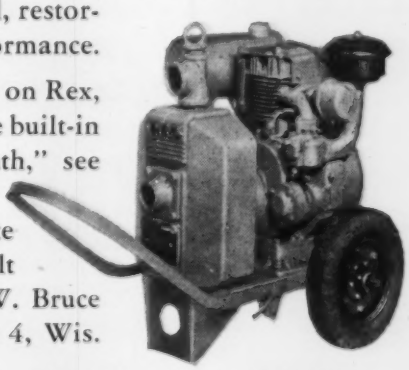
### 49 FORM CLAMPING AND TYING DEVICES

**Universal Form Clamp Company**—The Company's many form clamping and tying devices, building specialties, accessories for reinforced concrete, road accessories and its Uni-Form system of wall form construction are covered in Catalog 902, 40 pages 8½ by 11 inches. A section of particular interest is Design for Wall Forms, with its accepted table on the proper spacing of studs, wales and ties. Additionally, a new illustrated brochure on the Uni-Form Foundation Panel describing its use in residential building is available.

## "Reminds me of my Rex Pump!"

A Rex "Easy-Flow" Pump is always in the prime of life, thanks to its exclusive *adjustable* air peeler. For the priming efficiency of any self-priming pump is dependent upon its ability to peel air from the impeller. Rex assures top efficiency for the lifetime of the pump because Rex has the only peeler that can be adjusted to compensate for wear.

And, as a further aid to efficiency, Rex Pumps have a replaceable steel wearing plate that maintains the close tolerances between the side of the impeller and the volute so necessary for proper maintenance of vacuum. When wear takes place, the plate can be easily and inexpensively replaced, restoring original performance.

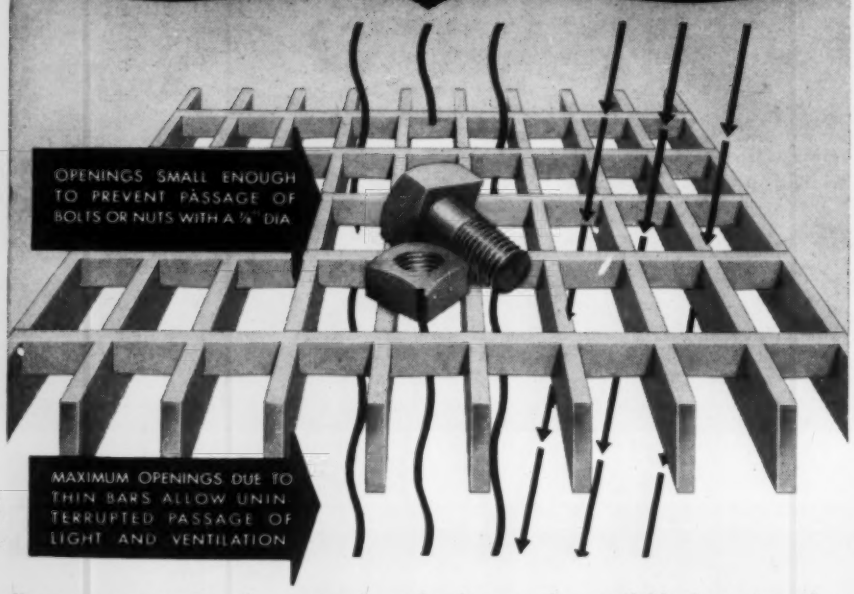


For all the facts on Rex, the pumps with the built-in "Fountain of Youth," see your local Rex Distributor or write direct to Chain Belt Company, 1688 W. Bruce Street, Milwaukee 4, Wis.

**CHAIN BELT COMPANY *of* MILWAUKEE**

**CONSTRUCTION MACHINERY**

# *This is* TRI-LOK
## OPEN STEEL FLOORING


OPENINGS SMALL ENOUGH TO PREVENT PASSAGE OF BOLTS OR NUTS WITH A ⅞" DIA
MAXIMUM OPENINGS DUE TO THIN BARS ALLOW UNINTERRUPTED PASSAGE OF LIGHT AND VENTILATION

Extra strong construction — openings closely spaced — available in rectangular, diagonal and U shapes — with Safety Steps. Ask for Bulletin 1140.

**DRAVO CORPORATION, NATIONAL DEPARTMENT**
**1103PITT BANK BLDG., PITTSBURGH 22, PA.**
*(Distributor for THE TRI-LOK COMPANY)*

DRAVO

Naturally you want a tracing cloth that's *truly* transparent — for greater speed, accuracy and minimum eyestrain. That's why you'll just naturally want to use PEL-X Tracing Cloth all the time, once you try it.

But Transparency isn't the only reason for the popularity of this tracing cloth. It also gives you maximum erasability with minimum feathering. Why not try PEL-X — now, today? PEL-X, water-repellent, white pencil tracing cloth is at your dealer's *now*.

# TRANSPARENT

## WITH A CAPITAL "T" FOR TRULY

**FOR BETTER PLANS . . . Better Plan on PEL-X Tracing Cloth**

WHITE PENCIL — PEL-X — WATER REPELLENT — TRACING CLOTH

Current Holliston Production includes: TRACING CLOTHS, COATED and IMPREGNATED FABRICS, INSULATING CLOTH BASE, SEPARATOR CLOTHS, MAP CLOTH, PHOTO CLOTH, REINFORCING FABRICS, SIGN LABEL and TAG CLOTHS, BOOKBINDING CLOTHS, SHADE CLOTH.

**THE HOLLISTON MILLS, INC. Norwood, Mass.** CHICAGO · NEW YORK


# CATALOG DIGESTS

### 50 FOUNDATIONS

**Drilled-In Caisson Corporation**—Literature describes foundation columns anchored in rock sockets; heavy column loads carried on single caissons; penetration through any type of soil to rock at any depth; examination or rock can be made; economy in time and labor; foundation bonded in rock; description, design, specifications technical data.

### 51 FOUNDATIONS AND HEAVY CONSTRUCTION

**Spencer, White & Prentis, Inc.**—Literature on the construction of difficult and unusual foundations; description of concrete-filled steel tubes driven to rock, including technical data, performance and installation, description of Pretest Underpinning and the application of the Pretest Method to construction other than foundations; Pretest foundations; caissons; foundations under existing buildings; shoring and moving buildings.

### 52 FOUNDATIONS AND SOIL BORINGS

**MacArthur Concrete Pile Corporation**—"A Special Pile for Every Condition" constitutes a brief description of the MacArthur literature on foundations. In a booklet and a recent leaflet are described the compressed straight-shaft pile, the compressed pedestal pile, and the permanent cased pile. Included in the booklet are a brief description of pile driving problems, mechanics of driving, and speeial notes and engineering information on cast-in-place concrete piles.

### 53 GASOLINE AND DIESEL INDUSTRIAL WHEEL TRACTORS

**International Harvester Company**—Selection of the right tractor for your job is simplified by a new catalog of International Wheel Tractors which is now available. This illustrated, 24-page, 2-color catalog lists many of the applications for which International Industrial Tractors are used and illustrates some of the matched equipment available with them. Three models of heavy-duty tractors powered by gasoline engines which can be equipped to burn kerosene or distillate are completely described and illustrated. All specifications are given.

### 54 GENERAL WELDING AND CUTTING PRODUCTS

**Air Reduction Sales Company**—announces a new 64-page, general welding and cutting products catalog. Profusely illustrated, this catalog is divided into two sections: one for oxyacetylene welding and cutting gases, equipment and supplies; the other for arc welding machines, accessories and electrodes. The last ten pages of the catalog are devoted to specially compiled electrode price lists.

### 55 HEATING, DIRECT FIRED

**Dravo Corporation's illustrated catalog** #516 describes the Dravo Counterflo Direct Fired Heater for industrial and commercial buildings. An outstanding development in open space heating, the Dravo Counterflo Heater burns gas or oil. The twelve-page bulletin discusses heating in general and describes the efficiency in combustion, heat exchange and distribution of Dravo Counterflo Heater. It also describes the use of stainless steel for combustion chambers.

### 56 HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING

**American Association of State Highway Officials**—New revised fifth edition contained in 2 clothbound volumes, 6x9 in. Official specifications are given for state, county, city and consulting engineers, highway contractors, material manufacturers and libraries. Price $6.00 (volumes not sold separately).

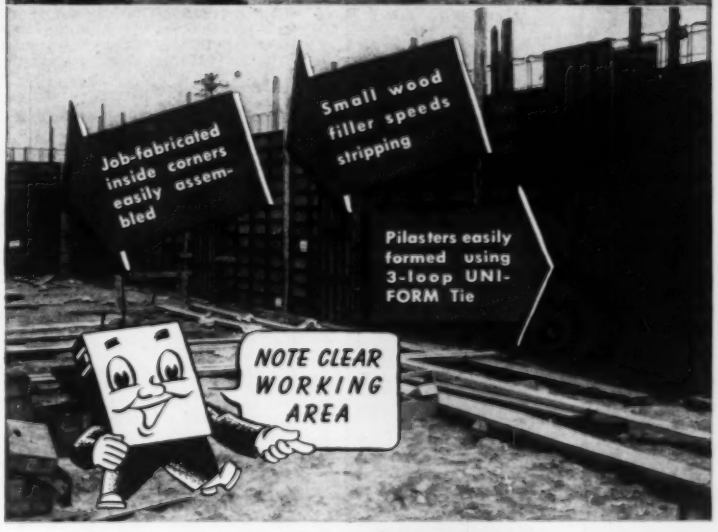
*N. B. There is a charge for these books. Please make checks payable to American Association of State Highway Officials.*

### 57 HYDRANTS AND GATE VALVES

**R. D. Wood Co.**—A 22-page booklet, "Mathews Modernized Hydrant," gives detailed description of its various features, with numerous photographs and sectional views to clarify the text. Appropriate space is devoted to the removable barrel, containing all the working parts, to the completely revolving head, and to the Sand-Spun protection case. A portion of this booklet is an illustrated treatment of gate valves that stay reliable under severe service conditions.

# ARE YOUR FORM COSTS HIGH?
## Save . . . with UNI-FORMS

Window boxes nailed directly to forms
Reinforcing steel is easily placed.
Projecting Ties ready to receive closure forms
Anchor slot nailed directly to forms
ONE SIDE OF WALL COMPLETELY ERECTED, LINED AND BRACED


Job-fabricated inside corners easily assembled
Small wood filler speeds stripping
Pilasters easily formed using 3-loop UNI-FORM Tie
NOTE CLEAR WORKING AREA

### ONLY THE UNI-FORM SYSTEM OF WALL FORM CONSTRUCTION HAS ALL THESE ADVANTAGES:

- Structural strength of a steel form PLUS a much desired *nailing surface.*
- Faster erection—easier stripping—because UNI-FORM Ties quickly and easily tie and lock UNI-FORMS into a tight, rigid form.
- Requires one side alignment and bracing—saves 25 to 50% time, material and money.
- One side of the form is erected—box-outs, window boxes, conduit, ducts, etc., *nailed directly* to the panels.
- Special forming requirements—brick ledges, pilasters, offsets, etc., are quickly and easily handled without "special" materials.
- The lowest material and labor cost of *any other method* of forming for concrete construction.

UNIVERSAL FORM CLAMP Company
Concrete Form Specialists for 34 Years
Founded 1912
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Better Serving Wherever You Build

*The UNI-FORM System of Wall Form Construction is saving building time and costs on every type of concrete construction:*

HOUSING • SCHOOLS • HOSPITALS • FACTORIES
THEATRES • STADIA • SEWER & WATER SYSTEMS
TREATMENT AND DISPOSAL PLANTS

**Concrete Forms • Form Ties • Brick Ties • Reinforcing Steel Supports and Building Specialties**

# HYDRANTS & VALVES

**Pipe Line Accessories for Water Works and Sewage Works**

*Write for Catalog No. 34*

VALVES: A.W.W.A. type iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position.

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B & S FITTINGS
CUTTING-IN TEES

**M&H VALVE AND FITTINGS COMPANY**

ANNISTON, ALABAMA


# CATALOG DIGESTS

### 58 HOIST DRIVE

**General Electric Company**—This drive is recommended for hoists which handle a wide range of loads, and where accuracy, speed, refined performance, and safety are important. It provides maximum speeds in the raising and lowering of the empty hook, automatically controlled speeds in hoisting or lowering safe overloads, and an inherent stall characteristic which prevents the lifting of excessive overloads. Its advantages on overhead traveling cranes, hammerhead cranes, cargo winches, revolving derricks and other hoists are described in the booklet "Maxspeed Hoist Drive," which also reports on the performance of this drive in speeding concrete placement.

### 59 THE HORTONSPHERE

**Chicago Bridge & Iron Company**—Announces the publication of a new booklet describing the advantages of storing highly volatile liquids in Hortonspheres to reduce evaporation losses. Charts making it possible to determine the vapor pressure of the product to be stored at a given temperature, and the correct storage pressure required to prevent standing losses from volatile liquids are included in the booklet.

### 60 THE HORTONSPHEROID AND HEMISPHEROID

**Chicago Bridge & Iron Company**—A new 16-page booklet describes the reduction of evaporation losses from motor and natural gasolines by storing them in Hortonspheroids or Hemispheroids. Cut-away drawings showing general design of noded and plain Hortonspheroids and Hemispheroids, and a standard capacity table are also included in the booklet.

### 61 IDLERS, BELT CONVEYORS

**Chain Belt Company**—A new 26-page bulletin on the complete line of Rex Belt Conveyor Idlers. Photographs, tables, charts, diagrams and cutaway views are used profusely to illustrate and describe the items. The first section is devoted to the proper selection of idlers. A large two-page cutaway illustration shows details of construction of Rex Idlers. There appears a section on special application idlers, and a two-page spread on Rex Belt Conveyor Accessories. Included are photos and illustrations of the two newest Rex Idlers—the Impact-Cushioning Troughing Idler and the Rubber Covered Spiral Return Idler.

### 62 INFILTRATION COLLECTORS

**Ranney Method Water Supplies, Inc.**—A seventeen page booklet, entitled "Industrial and Municipal Water," describes the basic principles involved in the design and construction of horizontal infiltration collectors. Included are a list of completed installations and reprints of several technical articles which summarize actual operating experience. Four diagrams and eight construction photographs illustrate the text of the booklet.

### 63 LEROY LETTERING BOOKLET

**Keuffel & Esser Co.**—A Leroy Lettering Set enables any draftsman to do perfect lettering with speed and ease. Fully illustrated, this booklet (A13) gives complete information on Leroy Lettering Sets, Templates, Scribers, Pens and accessories. Besides the regular Leroy alphabet templates, several new templates of practical values are illustrated and described. These include Map, Welding and Electrical Symbol Templates, Isometric Drawing Templates, Reversed Gothic, Condensed Gothic, Outline Gothic, Cheltenham and Greek alphabet templates.

### 64 LIMITORQUE AUTOMATIC CONTROL

**Philadelphia Gear Works, Inc.**—presents a new catalog pertaining to Limitorque Automatic Control, a mechanically actuated device for the operation of valves on steam, air, gas, water and oil lines. The simplicity of the mechanism, the ease and convenience of operation, and the adaptability to existing equipment are some of the advantages of the device discussed in the catalog.

### 65 MECHANICAL PIPE JOINTS

R. D. Wood Co.—A 4-page leaflet describing mechanical joints that meet the requirements for permanent tightness of pipe joints under conditions of deflection, expansion, contraction and vibration. They are designed for high-pressure lines for oil, gas, water, steam, or chemicals.

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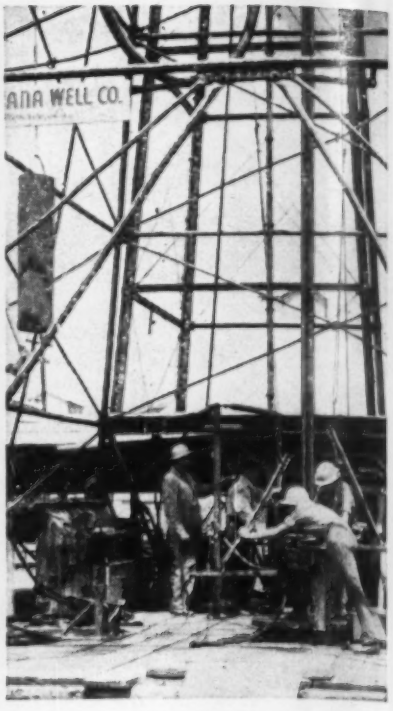


# 4 LAYNE UNITS FOR W. MONROE, LA.

The city of West Monroe, Louisiana will soon have four complete Layne Well Water Supply units and an adequate supply of water to fulfill the needs of a growing and thriving oil metropolis. The first two were bought on confidence in the name Layne . . . but the third and fourth purchases were based upon known knowledge of how Layne Well Water Systems perform.

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# CATALOG DIGESTS

**66 MODERN WATER STORAGE IN ELEVATED STEEL TANKS**

**Pittsburgh-Des Moines Steel Company**—presents a 20-page bulletin which describes 50 typical installations of elevated steel water tanks, and details 28 of their features and advantages. In addition, the bulletin offers tables on steel reservoirs, fire flow requirements, water friction in pipes and elbows, and other tables giving information pertaining to water storage.

**67 MORE POWER TO YOU**

**Allis-Chalmers Manufacturing Company**—The new 8-page illustrated announcement describes in detail the structural design and new features of all a-c power units which enable them to provide thousands of hours of economical service. "On-the-job" pictures of the different units demonstrate the wide variety of applications the five sizes of units can accommodate such as stone crushing, power hoist, sawmill operations, air compressors, water pumps, generators, and rock crushing operations.

**68 CONTRACTORS PROFIT WITH DIESEL MOTOR GRADERS**

**Caterpillar Tractor Company**—The many and varied applications of Diesel Motor Graders, the reasons for such usage and the advantages to a contractor are outlined in a new 8-page color booklet. Descriptive pictorial material and concise editorial comment portray the motor grader as a companion to the tractor, bulldozer, and scraper, emphasizing how it increases production and minimizes costs while releasing pioneering tools for their heavy earthmoving tasks.

**69 NEWLY IMPROVED WHEEL TRACTOR WITH INDUSTRIAL MOWER**

**Allis-Chalmers Manufacturing Company**—A new 4-page bulletin lists features of the newly improved Model B Wheel Tractor with industrial mower. The bulletin contains detailed illustrations of the machine showing its new and improved features. It also gives specifications of Model B, and explains how ease of handling, and low operating and maintenance costs make this machine a welcome addition to jobs calling for mowing of highways, parks, boulevards, airports, golf links, or railroad rights-of-way.

**70 OPEN STEEL FLOORING**

**William F. Klemp Company**—announces republication of their catalogs entitled "Klemp Open Steel Gratings and Stair Treads, The Perfect Structural Steel Floor" containing full technical details and photographs of their riveted and welded gratings, as well as new catalogs entitled "Hexteel Heavy Duty Surface Armor" and "Floorsteel, The Flexible Floor Armor That Rolls Out Like A Rug."

**71 OPEN-WEB STEEL JOISTS**

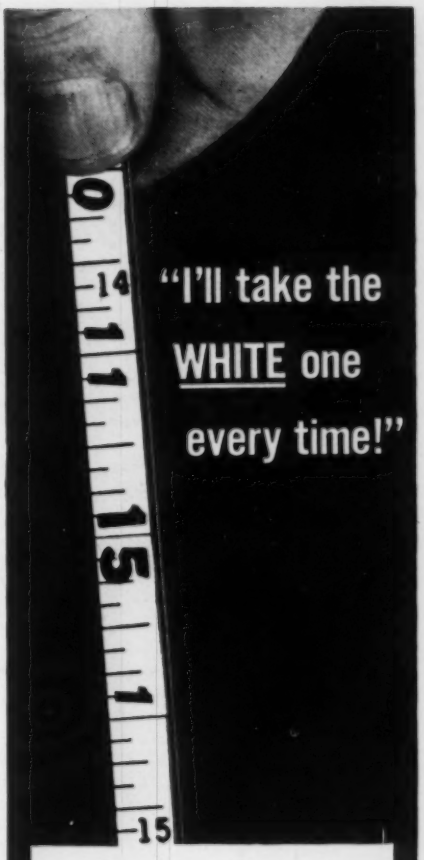
**Bethlehem Steel Company**—A 36-page booklet describing two general types of open-web steel joists, the standard joist produced in lengths up to 32 ft., and the long span joists, available in lengths up to 64 ft. and greater. A number of tables giving properties, dimensions, marking system for ordering, and other information are included. Numerous illustrations show typical buildings employing these types of joists.

**72 OZALID**

**Ozalid Division, General Aniline and Film Corporation**—A comprehensive booklet describing versatile methods of reproducing anything drawn, typed, printed, or photographed on translucent material by the use of Ozalid products in conjunction with the Ozalid machine. Described are: mass production of a drawing, design changing, eradication of obsolete areas of an original, foils to make composite prints, proving of color separation positives before printing plates are made, Ozalid Chemistry, storing of sensitized materials, process of developing, and a plan for the layout of a printing room.

**73 PARABOLIC FLUME**

**Simplex Valve & Meter Company**—An instrument able to measure extremely low flows with unusual accuracy is described in a special booklet. This bulletin describes the measuring device, adapted for installation where low head conditions exist and liquid containing solids must be measured without clogging the primary device. The bulletin outlines general purposes and use of this unit and illustrates types of installations and locations where it may be used.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The man who knows and uses measuring tapes instantly recognizes the superiority of WYTEFACE "A" Steel Tapes. Raised black graduations and rims, on a crack-proof white surface, make these steel tapes as easy to read in the brightest glare as in the dimmest light. See WYTEFACE "A" heavy duty and general purpose steel tapes at your dealer's, or write for catalogue.

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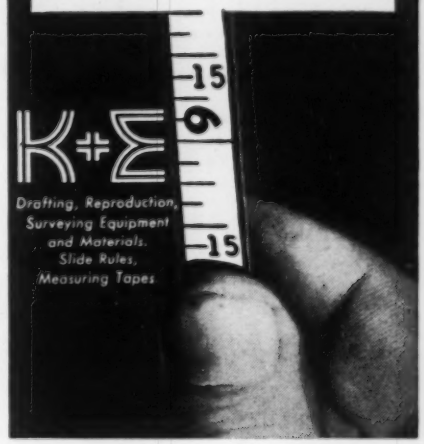

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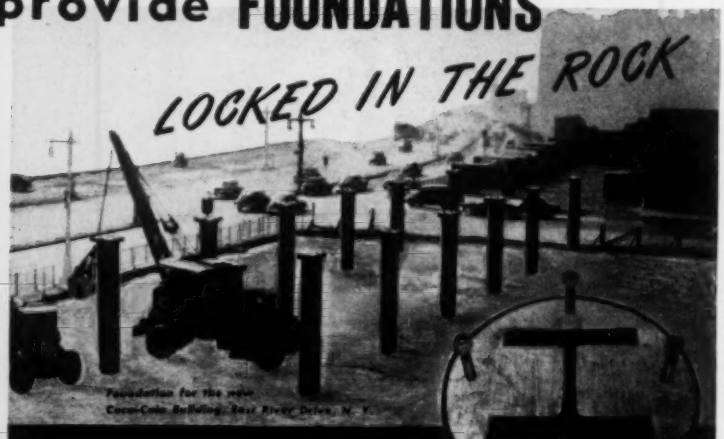

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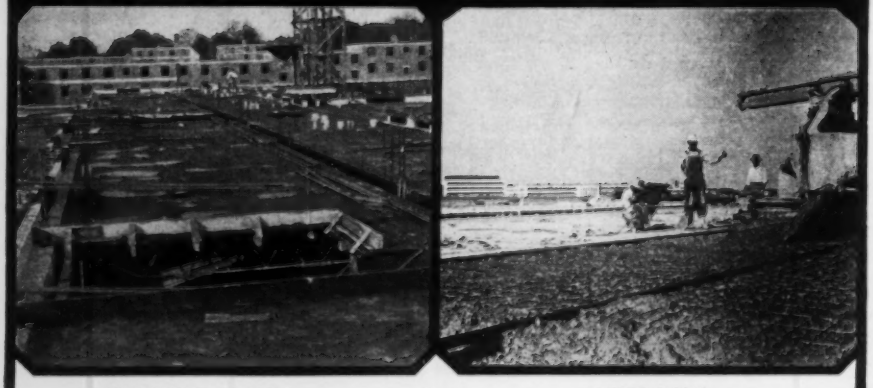

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# CATALOG DIGESTS

### 74 PAVEMENT CONSTRUCTION

**Wood Manufacturing Company**—Bulletin No. 54 entitled, "The Fastest Metnod of Low-Cost Paving," is a 10-page illustrated bulletin describing the Wood Roadmixer, travel-plant method of pavement construction. Describes hook-up of unit to crawler tractor and binder supply truck. Mixing action is diagrammed, binder volume control is illustrated and detailed installation, operation and parts views are shown. Complete specifications are listed.

### 75 PIGMENT-TO-PAPER WRITEABILITY

**Eberhard Faber Pencil Co.**—Brilliant, clear colors that "take" easily and will not wash off because they are "weatherproof" are described in an eye-appealing, illustrated pamphlet offering Van Dyke Thin Lead, totally waterproof colored pencils. Superlative qualities listed and described are: brilliancy and variety of colors, strength of lead, legibility on glazed paper, ease of reading, and smooth gliding.

### 76 PILES

**Raymond Concrete Pile Company**—Raymond Standard and Step Tapered Piles are described in literature which also includes information on the scope of Raymond's activities which cover every recognized type of pile foundation including poured concrete, precast concrete, composite wood and concrete, steel, pipe, and wood. Raymond's activities and experience also include the construction of caissons and construction involving shore protection, shipbuilding facilities, and harbor and river developments.

### 77 PILE, TAPERED TUBULAR STEEL

**The Union Metal Manufacturing Company**—Descriptive information and engineering data on Monotube steel piles. The Monotube is a fluted, tubular steel pile, fully tapered or combining tapered and uniform sections. It is driven directly with standard pile-driving equipment without use of driving core or mandrel. Available in: Nominal Butt Diameters of 12", 14", 16" and 18". Tapers: 1" in 7 ft.; 1" in 4 ft.; 1" in 2 1/2 ft; Wall Thicknesses: Gauges No. 11, 9, 7, 5, 3. Lengths are assembled in shop or field as required. Advantages listed: easy handling, speedy driving, economical field extendability to meet varying length requirements, internal inspection after driving, high load-carrying capacity with consequent economy per ton of load carried.

### 78 PITOT EQUIPMENT

**Simplex Valve & Meter Company**—Pitot Equipment generally used in trunk main service, distribution service, checking of large meters and pumps, and determination of water waste is described in a special bulletin. Air removal is covered in detail in this bulletin, which also describes use and care of the Simplex Pitot Tube and Manometer and the Simplex portable Pitot Recorder. Theory, formulas, notations, and tables and curves for use with this equipment are included.

### 79 POLARISCOPES

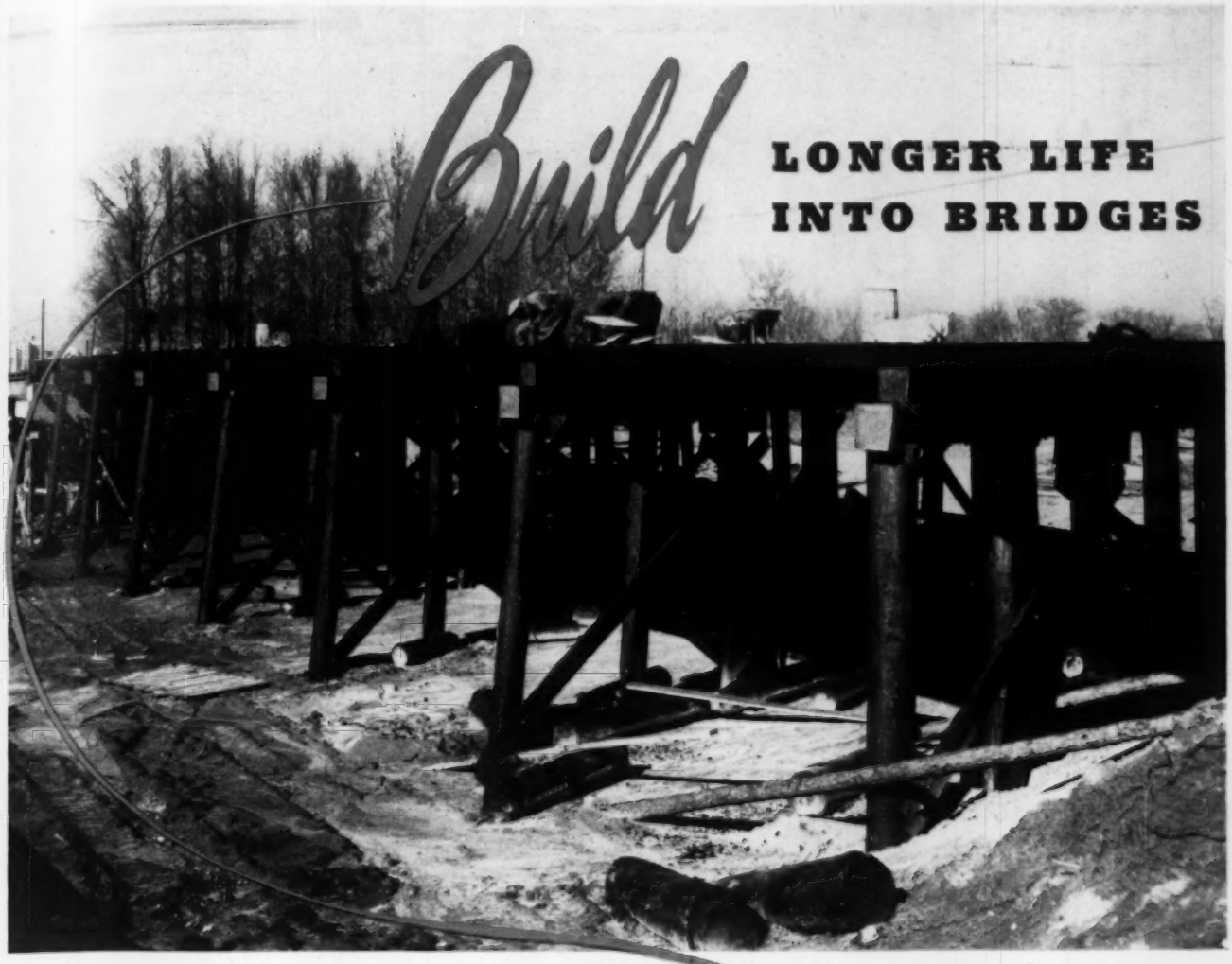
**Polarizing Instrument Co., Inc.**—To the machine designer, photoelastic stress analysis is not only of value in the verification of calculations based on theoretical solutions, but also in the solution of problems where theoretical analysis is not available. Literature describes photoelastic equipment and its use.

### 80 PORTABLE AIR COMPRESSORS

**Gardner-Denver Company**—Portable air compressors with capacities from 105 to 500 ft are described fully in two bulletins recently issued by the company. Both diesel and gasoline engine driven compressors of the 105 and 210-ft class are described in Bulletin XPC-15. The larger size compressors, which include 315, 365, and 500-ft capacities are featured in the new Bulletin PC-12.

### 81 POWER UNITS

**International Harvester Company**—A comprehensive two-color catalog giving detailed information on four sizes of international carburetor-type power units and four Diesel power units having a wide horsepower range. Specifications, dimensions, power curves, and attachments are illustrated and described. The catalog lists features of International Diesel engines and gives an explanation of the International gasoline starting system for Diesel engines. It contains a detailed description of the International gasoline engine combustion chamber design.

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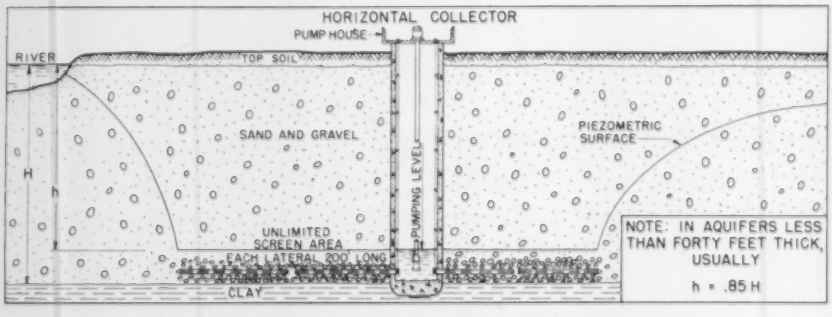
In shallow infiltration aquifers the maximum possible differential in water level available to move water from the source to the collecting unit is sharply limited.

As will be shown in this space at another time, a fundamental principle in ground water design is that the screens of the water producing units shall never be dewatered. This imposes a severe limitation on conventional wells, as it limits their screen area, hence, their efficiency. Horizontal collectors utilize more of the available head and can have a screen area which is as large as desired, hence operate with equal mechanical efficiency in any thickness of aquifer and with greater hydraulic efficiency than any vertical well.




**RANNEY METHOD WATER SUPPLIES, INC.**
**63 S. High St., Columbus, Ohio**
Water Supply Engineers and Contractors


## CATALOG DIGESTS

### 82 PRECISION BUILT ENGINE

**Clinton Machine Company**—announces a new folder on a precision built, all-purpose air-cooled engine. Reasons given for leadership of the engine described are: its ability to out-perform and out-last other rated engines of the same hp and weight, trouble free, compact, economical, in service under all conditions, and gaged to closest tolerances before assembly.

### 83 PRELIMINARY SURVEY PROCEDURE

**American Paulin System**—This booklet, available without charge to all civil engineers, is published in the interests of greater efficiency and economy of time and labor in the making of preliminary surveys under all conditions. The observer and author of this work, Raymond A. Hill, M. ASCE, of the widely known firm of Quinton, Code and Hill, Consulting Engineers, explains in detail the practical use of the Paulin System Altimeter in connection with all branches of preliminary field surveying. Geologists, scientists, topographers, surveyors and educators will find this book of interest and technical value.

### 84 PROGRESS IN STEEL CONSTRUCTION

**Fort Pitt Bridge Works**—A 56-page brochure entitled "50 Years of Progress in Steel Construction," contains over 150 photographs of the company's installations. Various types of bridge construction are exemplified, and bridges, office and other public buildings, industrial, marine, and many varied types of Fort Pitt installations are illustrated and briefly described. The company's engineering and manufacturing facilities are also detailed pictorially, showing the organization which makes possible the widely diversified activities in which Fort Pitt Bridge Works is engaged.

### 85 PUMPS

**The Jaeger Machine Company**—Catalog P-45 provides complete data on "Sure Prime" centrifugal pumps. Capacities from 3,000 to 240,000 gph in portable and stationary models; gasoline, electric and diesel powered. Also self-priming jetting pumps for pressures to 250 lb and high-head caisson pumps. Describes many features of design, priming action, and construction exclusive in this line and method of enclosing the engines with the pumps for weather protection and maintained efficiency.

### 86 REVISED ENGINEERING INSTRUMENT CATALOG

**W. & L. E. Gurley**—A newly revised edition of the 50-page illustrated catalog describing a complete line of engineering instruments. Included are detailed analyses of transits, engineers' levels, precise leveling rods, alidades and topographic instruments and equipment. Also discussed and diagramed are several pattern designs of glass reticles.

### 87 ROAD MIXER

**Wood Manufacturing Company**—Bulletin No. 36 describes the Wood Roadmixer Model No. 36, a new self-propelled traveling mixing plant. One-man operated, it handles up to 4 cu. ft. windrows. Mixing speeds from 11.5 to 71 ft per min., 100 to 150 tons of mix per hour. Model 36 incorporates all of the proved features of the larger Wood Roadmixers plus maneuverability, speed, and self-propulsion. Complete specifications are shown and model is illustrated.

### 88 ROTOTROL

**Westinghouse Electric Corporation**—Booklet explains how Rototrol regulates voltage, speed, current, power, speed and torque, power-factor, and position, and provides stability control and current limiting. Photographs, schematic diagrams, and performance curves are used to describe Rototrol applications in the automotive and aviation, central station, construction, machine tool, marine, metal-working, mining, paper, rubber, textile, and other industries. Seven pages of technical information are also included giving additional data on the theory, design, and operating principles of standard Rototrols and several frequently used modifications.

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Read all of the 112 items
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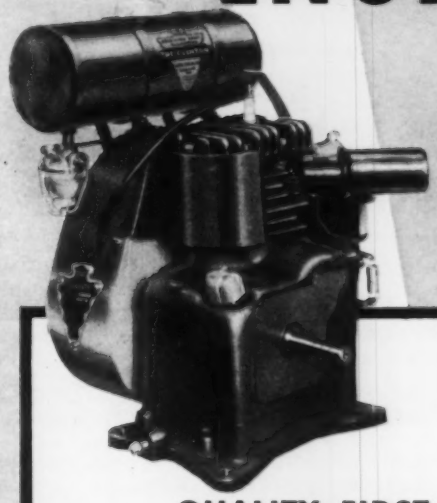

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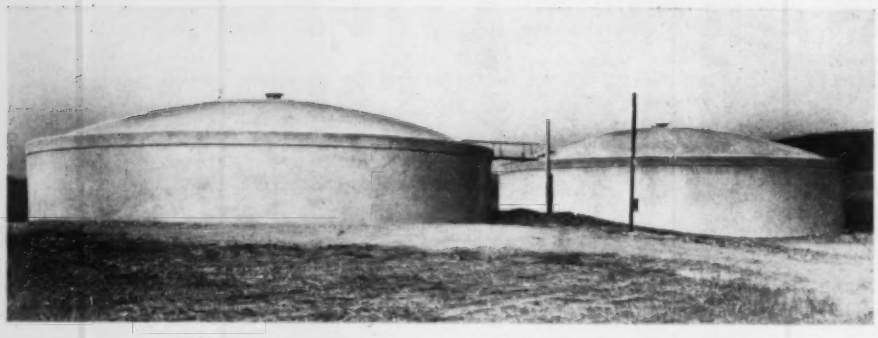

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**Our new bulletin B2300 describes this and many other uses of "GUNITE." Write today for your free copy of this bulletin.**

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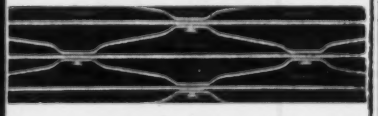
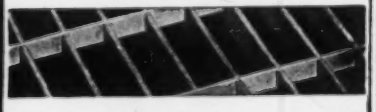


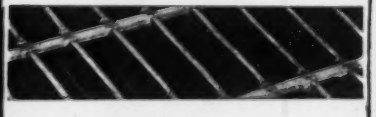
*Riveted*

Walkways — Stair Steps — Platforms
Trucking Aisles — Trench Covers



*Press-Locked*

Industrial Plants — Oil Refineries
Chemical Plants — Power Houses
Naval and Merchant Ships
Locomotive, Passenger and Freight Cars



*Welded*

Catalog for the asking.

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LONG ISLAND CITY 1, NEW YORK
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# CATALOG DIGESTS

### 89 SEVEN TYPES OF VALVES

**Golden-Anderson Valve Specialty Company**—Seven types of valves, examples of more than 1,500 standard types and sizes, are described and illustrated in a new 4-page bulletin. Included are pressure reducing valves, single-acting standard altitude valves, integral pilot type cold water float valves, railroad track pan float valves, water strainers, counter-balanced railroad standpipe valves and water columns.

### 90 SEWAGE WORKS MATERIALS

**Johns-Manville**—Brochure TR 38A, in two parts, 78 pages, size 8½ × 11. Part one is an illustrated presentation of many actual applications of the various J-M asbestos products which have come to find broad application in the sanitary field. It includes sewer pipe, insulations, packings and gaskets, roofing and flooring, etc. Part two is a catalog containing descriptions of these products with recommendations for their use.

### 91 SKETCHING AIDS

**Koh-i-Noor Pencil Company, Inc.**—publishes a small folder illustrating and describing many items manufactured by them which are suitable for the use of the draftsman, engineer, and artist.

### 92 STEEL FOR HIGHWAYS

**Bethlehem Steel Company**—"Steel for Highways" is the title of a 26-page booklet describing Bethlehem's ability to supply everything in road steel. The various products covered in the book are listed in the divisions, Right-of-way—Highway Bridges—Bridge Foundations—Paving—Highway Guards and Posts. The products included are: reinforcing bars, structural steel, pipe, bar mats, mesh, road joints, wire rope, highway guards and steel posts, steel piling, drill steel and many other products even down to form nails. The selective character of this booklet makes it of definite value to the highway contractor.

### 93 SURVEYING INSTRUMENTS

**David White Company**—12 pages of comprehensive information and prices on transits and levels. Bulletin includes all specifications on the instruments and accessories plus photographs and drawings.

### 94 SURVEYING INSTRUMENTS

**Keuffel & Esser Company**—Keuffel & Esser instruments and surveying accessories are again availaible, the company reports. Two bulletins, extracts from their 40th edition catalog describe this equipment. The first, "K & E Engineers' Surveying Instruments," describes in 68 pages the various transits, levels, compasses, hand levels and plumb bobs; the second, a booklet of 24 pages, lists, describes and illustrates Keuffel & Esser's Level and Range Rods.

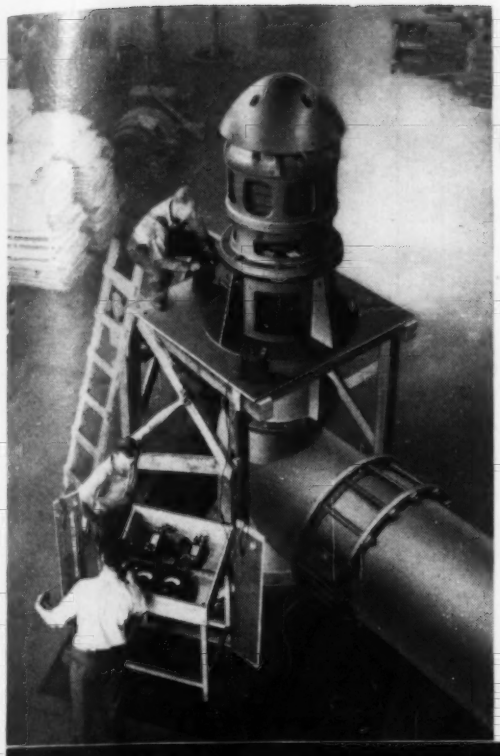
### 95 SURVIVAL AND RETIREMENT EXPERIENCE WITH CAST IRON WATER MAINS

**Cast Iron Pipe Research Association**—A brochure reprinted by the permission of the A.W.W.A. gives, in chart form, facts ascertained about cast iron water mains in the recent study conducted in 25 cities by a committee representing American Water Works Association, New England Water Works Association and the Institute of Water Supply Utilities. Tabulations showing in detail the survival and retirement experience with cast iron mains in various sizes are given for each city.

### 96 TECHNICAL BOOKS

**John Wiley & Sons, Inc.**—Catalog describing 1,350 titles in all the fields of pure and applied science. Of particular interest are the more recent books in civil engineering, such as Seelye's "Data Book for Civil Engineers," Froesch-Prokosch's "Airport Planning," Maugh's "Statically Indeterminate Structures," Peabody's "Design of Reinforced Concrete Structures," Creager-Justin-Hinds' "Engineering for Dams," (3 volumes); Babbitt's "Sewerage and Sewage Treatment," (6th edition); Tracy's "Surveying—Theory and Practice;" Callaham's "Russian-English Technical and Chemical Dictionary;" Robb's "Engineers' Dictionary."

All industrial literature is costly. Please restrict your request to the booklets of use to you.



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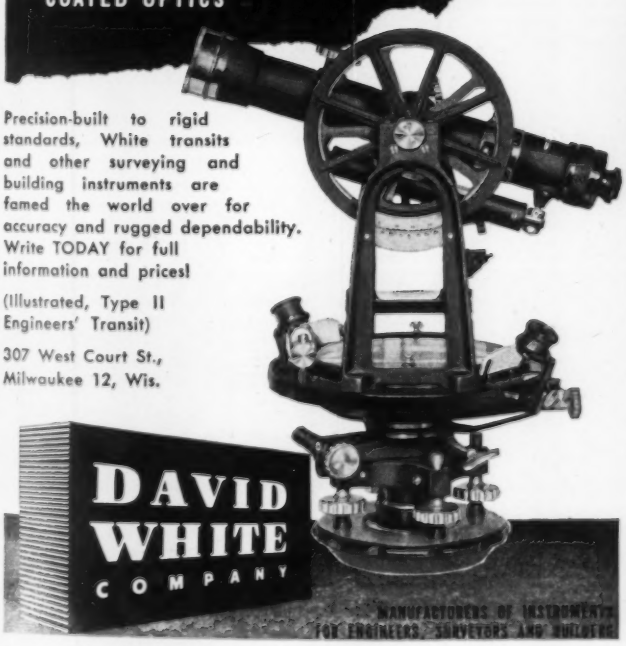

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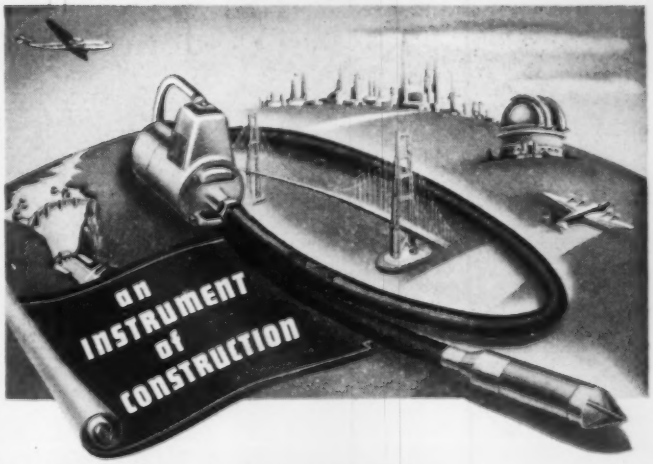


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# CATALOG DIGESTS

### 101 TRUCK FLEET MOTOR OIL

**Standard Oil Company (Indiana)**—46-page Stanolube HD Booklet. Comprehensive technical discussion of this heavy-duty motor oil of primary interest to engineers who operate truck fleets. Stanolube HD was developed to combat and control fuel soot and carbon deposits in Diesel and heavy duty engine operation. Unretouched color photographs illustrate actual test results on engine parts.

### 102 TUNNEL BUILDING

**The Commercial Shearing & Stamping Co.**—A new 272-page book on tunnels with a chapter on tunnel geology by Carl Terzaghi. There are over 300 subjects covered in this book and it is a source of specific information on tunneling, covering phases and formulas never before published. This book is priced at $2.50 postpaid.

*N.B. There is a charge for this book. Make checks payable to The Commercial Shearing & Stamping Company.*

### 103 TYPES AND SIZES OF GEARS AND SPECIAL MACHINERY

**The Earle Gear and Machine Company**—New 24-page catalog describes, in pictures, blueprints and text, the various types and sizes of gears and special machinery. Included are such products as spur gears and pinions, herringbone and hobbed type gears and pinions, worm gears and wheels, various non-metallic gears, racks, sprockets, sheaves and special machinery used in operating dredges, bridges, gates, hoists, mills and others.

### 104 VARI-TYPER

**Ralph C. Coxhead Corporation**—has issued a new booklet describing the many uses for the Varityper, a lettering machine used by many engineering organizations to replace lettering on tracings. The equipment is described fully, showing specimens of the work produced.

### 105 VIBRATORS, CONCRETE

**Viber Company**—The full line of interchangeable high-speed (9,500 rpm) concrete vibrators and the VIBER SLAB multiple vibrating attachment for full depth vibration of heavy duty high way and airport runway work is illustrated and described in the Viber catalog. In addition to general specifications and specification details for each unit, the catalog concisely points out new features, proved advantages and recommended applications. The time and money saving advantage of high speed Vibers is also outlined.

### 106 WATER FILTERS

**%Proportioners, Inc.%**—Bulletin 1550 describes new diatomaceous earth pressure type water filters. The Pur-O-Cel Filters use diatomaceous earth instead of sand as the filter medium. They produce water of practically 0 turbidity at all rates of flow through the filter, even those considerably in excess of filter rating. These filters described in Bulletin 1550 save construction costs by being more compact, allowing higher filter rates and providing more filter area than equivalent size sand filters. Pur-O-Cel Filters eliminate chemical coagulation requirements except on highly turbid water, thus reducing filtration to a mechanical process, handled by low-priced personnel rather than technically trained high-priced personnel.

### 107 WATER LEVEL RECORDERS

**Leupold & Stevens Instruments**—Bulletin 12 illustrates and describes Stevens Water Level Recorders Types A35 and A35B: continuous recorders, unlimited in range, for many months' unattended operation. Bulletin 24, Stevens Water Level Recorder Type F: weekly recorder, unlimited in range; simple, portable, and sensitive. These instruments have been developed for river hydrography, water supply, ground water investigations, and sewerage.

### 108 WATER WORKS EQUIPMENT AND ACCESSORIES

**M & H Valve & Fittings Company**—offers a catalog covering AWWA fire hydrants, valves, fittings and other water works equipment and accessories for use in water distribution systems, filtration plants, pumping stations, sewage disposal plants and other water works and sewage projects.

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**VALVES**
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### 97 TILT-UP CONCRETE CONSTRUCTION

**Portland Cement Association**—offers two folders describing how Tilt-Up, used principally on one story commercial and industrial buildings and residences, reduces costs, requires minimum of forming, and simplifies methods of construction. Explained in detail are the method of tieing together panels by means of cast-in-place columns, and the use of power equipment enabling builders to tilt into position story height wall panels with door and window openings which have been cast horizontally, usually on previously constructed floor.

### 98 TRACING CLOTH

**Arkwright Finishing Co.**—12-page booklet containing $8^1/_2 \times 3^1/_2$-in. samples and specifications of four types of tracing cloth for ink or pencil drawings. Size permits convenient filing and adequate samples for testing and comparison.

### 99 TRACTO-SHOVEL

**Tractomotive Corp.**—The newly organized Tractomotive Corp. of Findlay, Ohio, offers a folder on the new Tracto-Shovel. The Tracto-Shovel folder emphasizes the hydraulic bucket control of the new unit designed especially for the Allis-Chalmers HD-5. Film strip views and "action shots" depicting various applications of the Tracto-Shovel keynote the message of this bulletin. Several features mentioned are: the bucket can be dumped or closed at any height, automatic tilt-back avoids spillage, mounting of the unit on the HD-5 allows ample clearance and unobstructive vision, and hydraulic down pressure which offers unusual digging ability.

### 100 TRACTOR

**Allis-Chalmers Mfg. Co.**—A two-color folder announcing the new Allis-Chalmers HD-5 Diesel tractor and outlining several outstanding features. This tractor, engineered completely new throughout, offers grease-packed truck wheels that require greasing attention only once every 1,000 hours. A General Motors 2-cycle engine provides steady dependable power. A large 7 × 11-in. picture of the tractor illustrates its long rigid track that provides excellent ground contact, excellent balance and reliable traction. Other pictures point out full visibility, accessible controls, a convenient gear shifting arrangement and features that simplify maintenance problems.

### 109 WATER WORKS MATERIALS

**Johns-Manville Corporation**—Brochure TR39A, in two parts, 72 pages, size $8^1/_2 \times 11$. Part one is an illustrated presentation of many actual applications of the various J-M asbestos products which are particularly suited to the exacting but varied requirements of this industry. It includes water pipe, insulations, packings and gaskets, etc. Part two is a catalog describing these products with further recommendations for their use.

### 110 WATER TREATING EQUIPMENT

**Permutit Company**—A new bulletin describes the Displacement Type Dry Chemical Feeder, adaptable to either acid or alkaline chemicals, which insures accuracy of feeding, allows an exceptionally wide feeding range, and permits reproducing of feeding rate for any feeder setting and stepless adjustment of dosage. Complete enclosure of feeding mechanism and inspection of feeding operation through a transparent door are advantages also described.

### 111 WIRE ROPE—LIFE AND COSTS

**Wickwire Spencer Steel**—Thousands of wire rope users—old hands and new—have found "Know Your Ropes" of inestimable value in lengthening life of wire rope. Contains 78 "right and wrong" illustrations, 41 wire rope life savers, 20 diagrams, tables, graphs and charts.

### 112 WOLMANIZED AND MINALITH TREATED LUMBER

**American Lumber and Treating Company**—Booklet explains how (1) Wolmanized preservative-treated lumber protects against decay, termites, and fire, and gives trouble-free service for years in structures exposed to high humidities and temperatures that cause rot to destroy ordinary wood in four or five years. (2) Minalith fire-retardant treated lumber reduces the inflammability of wood by pressure impregnation.